The Use of Salivary Cortisol as an Assessment Tool in Phobic Anxiety

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Abstract

This study examined the salivary cortisol response to the presentation of a phobic stimulus in ten spider phobic women. Blood pressure, heart rate and subjective units of distress were also monitored. It was found that saliva cortisol responded to the presentation of both the neutral and spider cues indicating a possible response to novelty rather than anxiety. Cortisol levels did not correlate significantly with the other measures. Systolic blood pressure and heart rate appear to be more sensitive indicators of anxiety than salivary cortisol.

Chapter One

Introduction

Anxiety is a core construct in psychology. It is a state experienced by all people to a varying degree at some stage of their lives. The pervasiveness of the anxiety differentiates 'normal' anxiety from that which becomes problematic and disruptive to a person's quality of life. The anxiety related disorders form a substantial body within psychopathology and unmanageable anxiety is a common impetus to the seeking of professional help. It is therefore a vital area for research which is borne out by the vast number of studies into the various aspects of it.

Previous authors have sought to make a distinction between the states of anxiety and fear. Nietzel, Bernstein and Russell (1988) refer to definitions of anxiety as being "generalized emotional distress" and fear as "an aversive emotion elicited by a particular stimulus". However this distinction will not be followed here because of the difficulty in ascertaining whether the state of anxiety has ceased to exert physiological influence once the actual stimulus is present. In other words, where does the state of anxiety give way to the state of fear as the cause of physiological change? Therefore this paper will refer to anxiety states even when the actual fearful stimulus is present. Similarly, the term "stress" is used to denote both a cause and an effect at various times. Much of the research reviewed here refers to stress in both of these contexts which may be confusing. Although different authors favour the use of different terminology the basic concept is the same. That is a negative emotional reaction is induced by confronting the subject with stimuli that are aversive to that person. This negative emotional reaction causes various physiological changes to prepare the body for dealing with the noxious event.

This thesis is concerned with the physiological assessment of anxiety using salivary cortisol as the dependent measure. An extensive body of research has established the usefulness of cortisol in assessing hypothalamic-pituitary-adrenal function in psychiatric disorder, especially depression (see for example Carpenter & Gruen, 1982). More recently cortisol has been applied to the evaluation of stress and anxiety. Cortisol has been shown to be reliably associated with states of anxiety and its potential as a research tool has been enhanced in recent years by the development of sensitive radioimmunoassay (RIA) techniques (see Cameron & Nesse, 1988; Kirschbaum & Hellhammer, 1989). These have enabled the analysis of cortisol in saliva which has many advantages over the earlier methods of blood or urine analysis. However further research is required in refining the techniques and in proving their reliability (Vining & McGinley, 1987).

Comparatively little work has been done in applying the method to the assessment of phobic anxiety. Cortisol has been tested in the blood and urine of phobic subjects but to the author's knowledge it has not been assessed in saliva. Therefore this research seeks to at least provide some information in this area.

The following is a brief overview of the normal action and secretion of cortisol and this is followed by a review of a representative sample of the research applying the analysis of cortisol in anxiety states. This review will not cover in any depth research into the role of coping mechanisms or research that examines the cortisol response to purely physical stress. The focus here is primarily upon the cortisol response in anxiety states, particularly phobic anxiety.

1.1 Assessment of Anxiety

The measurement of anxiety is a fundamental issue in research and in the clinical treatment process. Comparisons amongst research findings are of little value when it cannot be determined that they are measuring the same quantity or quality of anxiety. Similarly treatment gains or losses cannot be determined accurately if there is no common method of reliable assessment. Furthermore,

research into the most effective aspects of treatment cannot progress without some level of objectivity. However assessment methods need to be proven to be accurate, reliable and consistent. They also need to be easily applicable to a wide range of clinical and research settings.

Lang's (1971) paper provides the framework for much of anxiety assessment research. Lang argued that there are three response channels ; the subjective, overt behaviour and the physiological. Anxiety research usually involves measures from all of these channels. Self-report or subjective measures are the only means of access to a person's feelings but may be hampered by the possibility of bias. The research subject or patient may detect an unconscious expectation for their level of anxiety to increase or decrease and may report their feelings in accordance with this. It is also natural for people to endeavour to present themselves as favourably as possible, leading to another potential source of bias in self-report.

Behavioural assessment involves the recording of overt behaviour such as stuttering or fidgeting but may again be subject to certain biases inherent in either the subject or the observer. Physiological assessment is presumably the most objective of the three channels but is not without its problems which will be discussed more fully later.

It is desirable when conducting research into anxiety that all three channels are monitored. This is due to the well documented finding that the three response channels do not inter-correlate well. This phenomenon has been called desynchrony by Hodgson & Rachman (1974) and asynchrony by Lick & Katkin (1976). It appears that there are some people who respond quite markedly physiologically but can remain outwardly calm and vice versa. Some subjects may report large increases in their subjective feelings of anxiety but their physiological readings remain relatively unaltered.

Just as different individuals may experience anxiety to varying degrees along the three dimensions outlined, the effectiveness of treatment programs may depend on how well the treatment program matches their response. As Lang (1977) says:

"The therapeutic enterprise should be a vigorous multi-system program. That is to say, the patient who shows social performance deficits, the physiology of anxiety and also reports a feeling of dread or helplessness would most likely respond to a program which included the direct modification of each of these behavior sets." (p181)

Evidence to support this view is provided in two studies by Ost et al. (1981,1982). These two studies, one using social phobics and the other claustrophobics, split the subject pools into behavioural responders and physiological responders on the basis of their reaction in a pretest. These groups were further divided into those that received behaviourally focused treatment and those that were given physiological based treatment (ie. relaxation training). While both types of treatment yielded significant improvements, the most gains were made by the subgroups whose treatment type matched their response pattern.

Although there exists disparity amongst the three different modes of responding there also exists difficulty in assessing anxiety purely within the physiological mode. The application of many types of physiological assessment to clinical practice has been hampered by difficult methodology requiring varied technical skills and expensive equipment. In addition to this, the reliability of physiological measurement is not undeniably proven. Many individual differences exist as to which physiological indices show arousal and to what extent. This is thought to reflect dominance of either the sympathetic or parasympathetic nervous system over each other (Sturges & Gramling, 1988). Therefore current research is examining ways of improving the reliability of these methods. Research into physiological responders and non-responders is still incomplete and limits the drawing of firm conclusions. In more recent years, research attention has turned towards the possibilities of the neuroendocrine system and its response in anxious situations. This was perhaps stimulated by the growth in interest in stress research (Nesse, Curtis, Thyer, McCann, Huber-Smith et al., 1985). It is with this system that the focus of this thesis lies. In particular, researchers have been studying the effect of anxiety states on the level of certain hormones in the blood stream. Cortisol has been shown to be a useful hormone in this regard. However because of technical requirements its applicability to many research and clinical settings has

been limited. Recent advances in the analysis of cortisol has meant that it has seen a resurgence of interest. The aim of much current research is to explore the possibilities of cortisol as well as other steroid hormones as a research tool. To understand the relation between anxious arousal and cortisol release a brief account of the cortisol releasing mechanisms is offered.

1.2 Normal Action and Secretion of Cortisol

Steroid hormones of which cortisol is one, are released from the cortex of the adrenal gland. There are two mechanisms involved in the release of cortisol. One maintains homeostasis through a negative feedback loop and the other is a stress control mechanism which is capable of overriding the aforementioned system. Cortisol is not secreted continuously but in discrete bursts in the absence of any other stimulation (Kirschbaum & Hellhammer, 1989). Thus, cortisol release may be part of the everyday circadian pattern with higher levels in the early morning and lower in the afternoon and evening or it may be in response to a physical or emotional event.

Emotional stress activates the hypothalamic-pituitary- adrenal system instigating the release of glucocorticoids (Mason, 1968a). This is accomplished by the hypothalamus releasing corticotropin releasing factor (CRF) which stimulates the anterior pituitary gland to release adrenocorticotropic hormone (ACTH). This in turn stimulates the adrenal cortex to release glucocorticoids (Fredrikson, 1989). Cortisol is known as a glucocorticoid because one of its effects is the synthesis of glucose from body protein (Kerr, Ong & Johnston, 1991). Cortisol counteracts fatigue in heart and skeletal muscles and has facilitory effects on the central nervous system, decreasing thresholds for taste and smell. (Fredrikson, 1989). More recently it has been acknowledged that the glucocorticoids also act as a modulators of GABA, a major inhibitory neurotransmitter (Kerr et al, 1991). Cortisol has the effect of enhancing GABA at very low concentrations and opposing it at higher concentrations (Johnston, Kerr & Ong, 1987).

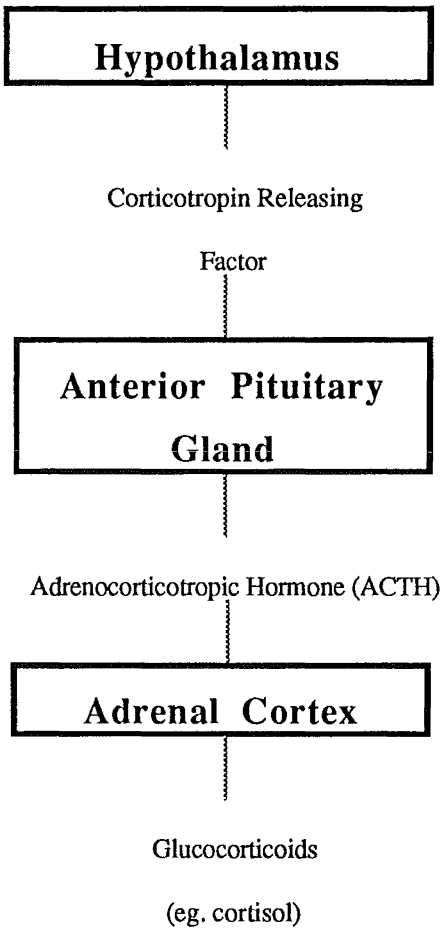

Figure 1. Hypothalamic-Pituitary-Adrenal Axis

About 90% of the secreted cortisol then binds to mostly corticosteroid-binding-globulin (CBG) and also to albumin; leaving approximately 5-10% circulating unbound or 'free'. It is the free plasma fraction that acts upon a large array of target tissues (Kirschbaum & Hellhammer, 1989). As the concentration of total cortisol increases the proportion of free cortisol increases as the capacity of CBG is consumed (Carpenter & Gruen, 1982; Kahn, Rubinow, Davis, Kling & Post, 1988). The cortisol profile of an individual appears to be relatively stable over time but seems to be more stable in the morning than the afternoon (Kirschbaum & Hellhammer, 1989; Kahn et al., 1988). This may be due to the

high levels of cortisol in the early hours creating a ceiling effect for any stimulation which might occur during this time.

1.3 Factors Potentially Affecting Normal Cortisol Release

There are various factors which may affect the normal circadian pattern of cortisol release. Research in this area cannot be considered complete as there are many areas where doubt still exists due to incompatible research evidence. However what is known thus far is summarised in this section.

The majority of reliable evidence suggests that there is no difference in cortisol levels between the sexes except that women may show a decline with age (Kirschbaum & Hellhammer, 1989). The effect of pregnancy and contraception containing estrogen is unclear. There is research pointing to unchanged cortisol levels during pregnancy (Landon, Smith Perry & Al Ansari, 1984; Guechot, Fiet, Passa, Villette, & Gourmel, et al., 1982) while other research reports elevated levels at least in the third trimester (Vining, McGinley & Symons, 1983). Kirschbaum & Hellhammer (1989) found there to be no difference in saliva cortisol between 19 women on estrogen based contraception and 16 controls throughout a 30 day period. An important point which may help reconcile differences in the research is the different levels of cortisol found in blood or saliva when studying women affected by increased estrogen levels. In pregnant women the level of cortisol in the blood may be elevated compared to others while the saliva level remains the same. At low concentrations of total cortisol the high affinity of CBG maintains free plasma levels of cortisol at correspondingly low levels. When the level of total cortisol is higher and the CBG binding sites become saturated, the level of free plasma cortisol increases. In pregnant women the CBG concentration is markedly elevated meaning that more of the total cortisol can still become bound. This results in high levels of total plasma cortisol with concurrently normal levels of saliva cortisol which indicates the unbound or free fraction.

It appears that the stage of the menstrual cycle does not affect the cortisol response to a psychological stimulus (Abplanalp, Livingston, Rose & Sandwisch, 1977). The effect of stage of the menstrual cycle on resting levels of cortisol is unclear as there is some evidence to support an effect (Genazzani, Lemarchand-Beraud, Aubert. et al., 1975) and other evidence indicating no effect for menstrual phase (Aubert, Lemarchand-Beraud, Deguillaume et al., 1971). However little research has been carried out in this area and there appears to be little or no research which studies the same women over several cycles. Therefore, because the situation is still unclear concerning the effect of menstrual phase on cortisol levels it is advisable not to use absolute levels in research. Some researchers have avoided using female subjects because of the uncertainty involved but a more desirable situation would be to become more vigorous in uncovering the relation among pregnancy, contraception, menstrual phase and cortisol levels. If cortisol is to be used as a research tool in anxiety research it is imperative that it can confidently be applied to female participants as they comprise a considerable proportion of those seeking help for anxiety-related problems.

Some other types of medications (for example prednisolone and metyrapone) may react with the antisera used in the analysis of cortisol by radioimmunoassay (RIA) thereby influencing the outcome (Kirschbaum & Hellhammer, 1989). Unless examining particularly for the effects of these medications it is advisable to use unmedicated subject populations.

In general the evidence points to nicotine increasing cortisol levels in smokers. One very small study (Cherek, Smith, Lane et al., 1982) found no effect of nicotine on saliva cortisol whereas Kirschbaum & Hellhammer (1989) found there to be at least a two fold increase in saliva cortisol 30 minutes after smoking which is in accordance with research on plasma cortisol (for a review consult Pomerlau & Rosecrans, 1989).

1.4 Measuring Cortisol in Saliva

Research into steroids in saliva began at least as early as the 1960s with the work of Katz and Shannon (1964). During the next two decades there was little ongoing research in this area until the work of Walker, Riad-Fahmy and Read (1978). The use of modern radioimmunoassay techniques in the analysis of steroids in saliva enabled much more reliable measurement. The use of saliva sampling instead of blood sampling also provided many other benefits. Obtaining a saliva sample is usually considerably less stressful for the subject. This is of great importance as the mere thought of the injection required for blood sampling is enough to cause an increase in cortisol levels (Kirschbaum & Hellhammer, 1989). Collecting saliva is a much more simple process which eliminates the need for trained medical personnel. Subjects themselves can take measures in the home and care givers can easily collect samples from children. No special storage facilities appear to be required before analysis as no differences were found between salivary cortisol kept at room temperature, 4° C and at -70° C for two weeks before assay by Kahn et al. (1988). Saliva sampling also allows for a great many more samples to be taken at close intervals if needed with no detrimental effects on the subject.

Most saliva enters the oral cavity by way of three pairs of salivary glands; the parotid, submandibular and the sublingual (Vining & McGinley, 1986). It appears that most cortisol in saliva enters intracellularly by diffusing through the cells of these salivary glands (Vining & McGinley,1987). Cortisol is highly lipid soluble and of small molecular size allowing it to diffuse easily through cell membranes (Kirschbaum & Hellhammer, 1989). Once in the cells of the secretory endpiece of the salivary glands, cortisol passes easily into saliva. Flow rates do not affect the level of cortisol in saliva (Vining & McGinley,1987; Landon et al., 1984). The high diffusion rate of cortisol enables the maintenance of a concentration equilibrium between the free fraction in plasma and in saliva (Vining & McGinley, 1986). The rate at which cortisol enters saliva is very rapid. Several studies have found that within one minute of intravenous administration of cortisol the saliva

level of the steroid increases correspondingly (Vining et al., 1983; Walker, Joyce, Dyas & Riad-Fahmy, 1984) with peak values observed within 1 - 2 minutes of the peak in plasma (Kirschbaum & Hellhammer, 1989) This compares with the relatively slow rate of excretion of cortisol in the urine (Bassett, Marshall & Spillane, 1987).

The usefulness of saliva cortisol as a research tool would be limited if it was not closely correlated with the cortisol level in the blood. Correlation coefficients of the levels of cortisol in the blood and saliva are usually reported to be at least .90 (Kirschbaum & Hellhammer, 1989). While the levels of cortisol in saliva mirrors that in the blood, absolute values are quite different because of the conversion of cortisol to cortisone in saliva (Brooks & Brooks, 1984; Landon et al., 1984). Because the salivary level reflects the free (unbound) plasma level, which is only 1-10% of the total plasma level, more sensitive assays are required in saliva sampling than that for blood (Vining & McGinley, 1986). Comparison of absolute values of cortisol in saliva amongst different research groups is problematic due to the different RIA kits used. The half life of cortisol in saliva has been recorded as high as 106-113 minutes by Peters, Hall, Walker & Riad-Fahmy, (1984) but a more conservative finding was that of 58 minutes by Hiramatsu (1981).

1.5 Cortisol Response During Anxiety

Besides the normal secretion of cortisol there are many different stimuli which elicit spontaneous secretory bursts. In the interest of brevity this review will be restricted to research on the psychological stimulation of cortisol release and will not cover cortisol response to physical stress. It is common in research examining the effect of stressful situations on cortisol levels to find varying responses. The general direction of results is for the cortisol level to increase but on an individual basis this is by no means a universal finding among subjects. There are many different paradigms for inducing anxiety amongst subjects and the following section will attempt to give coverage of a representative sample of findings from different

methodologies. Most earlier research and even some recent studies have utilised serum cortisol sampling and it is important to consider the effect that the use of this procedure may have had on the results as it is often in itself a stressful event.

A common stress-inducing tool has been the use of suspense films. Hellhammer, Rottger, Lorenzen and Hubert (1986) studied saliva cortisol in response to two different films; one said to induce a state of tension and the other a state of suspense. Cortisol appeared to respond to the suspense film but not the tension film. However, there was only a marked response to the first episode of suspense. This may be explained by two factors, the circadian decrease or possibly an habituation effect (Berger, Bossert, Krieg, Dirlich & Ettmeier et al., 1987). The circadian decrease may mask a cortisol response because the natural level of cortisol is decreasing at the same time as an emotional or physical stimulus causes an increase, resulting in a reduced or negative net effect. It is known that adrenal responses tend to occur on the first occasion of a stimulus and to become less pronounced or even reversed on subsequent encounters (Mason, 1968b). It is unknown at this point how quickly a human cortisol response abates to various psychological stimuli so it cannot be assessed if this factor is responsible or not. The difficulty with using the film paradigm is the uncertainty that all subjects will find the stimulus emotionally provoking. It is also very difficult to pinpoint a discrete episode of "suspense" as it may depend on the individual as to exactly when they perceive negative events to be developing in the film. Most of the studies employing this strategy have studied only male subjects while some others have neglected to indicate the sex of subjects at all. The fact that the running time of a movie often approximates 90 minutes may mean the cortisol response is tempered by the natural circadian decrease, although most studies using the film paradigm minimise this effect by conducting the experimental sessions in the evening when the rate of decrease is lowest.

In another study employing the film paradigm, Brown and Heninger (1975) showed their subjects three different films: a documentary, a sexually arousing film and an anxiety provoking one. The control film was always presented first with the

other two being counterbalanced in their presentation order. A possible novelty effect was evident from the fact that baseline levels of cortisol on the control day were higher than either of the experimental days. This effect might also be due to a reaction to blood sampling on the first day. Although only half of the subjects exhibited a clear cortisol response to the anxiety provoking film, those that did also reported more subjective anxiety. This is a finding that few other studies have managed to obtain. There was only one non responder who reported increased anxiety. However there were only eight subjects in total and these were all male. It was noted that although there was considerable variance across subjects on their average cortisol levels, within subject readings of elevated response levels were consistent over the three sessions. This study appeared to obtain a clearer physiological response than many others using this method of inducing psychological arousal which the authors attributed to the film quality, a discrete episode of suspense, and that the subject was alone in a sound chamber with minimal distraction.

There have been several attempts to relate cortisol responsiveness to personality variables. Using the Mirror Drawing Task to induce stress in both men and women, and measuring cortisol in the blood, Miyabo, Asato and Mizushima (1979) found that neurotic subjects (the authors did not say how this was defined) showed significant increases in cortisol whereas control subjects did not. This result was only evident through large individual changes whereas resting or elevated levels did not differ between groups. While there was no significant correlation between resting cortisol levels and Minnesota Multiphasic Personality Inventory (MMPI) those subjects that did show a cortisol response tended to be more "defensive" and tried to maintain good "self control over inner mental processes" (Miyabo et al., 1979). The cortisol responders also tended to show little overt anxiety. However Hautman and Bakker (1991) found that saliva cortisol response in their female subjects was not related to neuroticism but to their degree of social anxiety. Because it is not known how the 'neurotic' subject group was derived in the Miyabo et al. (1979) study, it cannot be ascertained whether these findings are necessarily incompatible.

In an attempt to help explain the interindividual differences in cortisol response to stressful films, Hubert and de Jong-Meyer (1989) correlated their subjects cortisol results with their scores on the State-Trait Anxiety Scale and the Beck Depression Inventory. They found no correlations between enduring traits and cortisol release. This concurred with previous research by Francis (1981). An interesting finding was the absence of a correlation between how suspenseful subjects rated the film and the level of cortisol released.

Berger, Bossert, Krieg, Dirlich, Ettmeier et al., (1987) highlighted the lack of research into individual differences in the susceptibility of the cortisol system. After measuring the serum cortisol response in 12 male subjects to a series of six different stressful tests, Berger et al. concluded that all their test situations, except the anticipatory stress test, caused a significant increase in cortisol secretion. The validity of this test is in question; however, as it merely involved telling the subjects that they were about to partake in a physical bike ride test. To those subjects who consider themselves reasonably fit, the anticipation of this task may have actually been pleasant and not anxiety provoking at all. There was no significant difference found among the five tests that did produce a response. In summarising their findings, the authors proposed that there was a continuum of complete reactors and nonreactors. However it remains to be proven that the tests were equally anxiety provoking to all subjects not that there was an inherent difference in the responsiveness of their respective cortisol systems. This study also found no significant correlation between subjective assessment of stress and cortisol response.

Using public speaking as an anxiety provoking task, Bassett, Marshall and Spillane (1987) found more evidence of divergent physiological responses. Although all participants in this study reported the task of preparing and delivering a 15 minute filmed lecture as extremely stressful not all physiological measures reflected this. Two measures of cortisol were taken: one from saliva and the other from urine. Although the saliva samples showed increased cortisol both before and after the speech, the urine samples showed an increase only after the speech,

reflecting the longer delay for cortisol to be excreted in the urine. Saliva cortisol is therefore a more accurate indicator of plasma levels and will give a better picture of reaction to particular stimuli than urinary cortisol. This study also found that diastolic blood pressure was unchanged before and after the stressor whereas both systolic pressure and heart rate showed small significant increases but only immediately after the event. There appeared to be no anticipation effect for these measures as there had been for saliva cortisol.

The preceding studies have all dealt with mixed subject populations. What follows is a summary of research into the cortisol response during phobic anxiety.

1.6 Cortisol Response During Phobic Anxiety

In assessing cortisol response during *in vivo* exposure to noxious stimuli such as birds, snakes and insects, Curtis, Buxton, Lippman, Nesse and Wright (1976) found there to be no adrenal response to anxiety. Their study was conducted over five, three hour sessions with *in vivo* exposure occurring only on the third and fourth sessions with the other sessions being used as control sessions. Cortisol was assessed in the blood every 20 minutes during the early evening. This is the time of minimum circadian release. While there was no visible effect of the *in vivo* treatment, there was a downward trend in cortisol level over several sessions, depicting a novelty effect which dissipates as subjects experienced more sessions. A likely explanation offered by Curtis et al. (1976) for the lack of a cortisol response was that it had habituated. Mason (1968b) noted the tendency of adrenal responses to occur on initial contact with a stimulus and to diminish on subsequent encounters. It is possible that phobic patients have had many encounters (real or imagined) with the phobic object and therefore have a subdued response. They may react to the novelty of the experiment rather than to the feared stimulus itself.

Using exposure to slides of phobic stimuli, Fredrikson, Sundin and Frankenhaeuser (1985) tested the cortisol response of eleven subjects by taking urine samples. Ten of the subjects showed a higher level of cortisol after exposure

to phobic slides than pretest and nine of the subjects showed a greater cortisol response to the phobic slides than to the neutral ones of flowers. Subjects responded with cortisol level increases of 350% of the pretest level on the phobic day compared to a 225% increase on the neutral day. However a considerably higher baseline level on the neutral day may have made the phobic response seem greater than it actually was, especially as ceiling effects may have interfered in this study. Again, this study produced evidence of desynchrony of the fear response in that there was a lack of correlation between subjective distress, cortisol excretion and skin conductance.

There are several methodological differences which may account for the discrepant results between the Fredrikson et al. (1985) study and that of Curtis et al. (1976). First the later study analysed urine samples instead of blood. Venipuncture can be an unpleasant procedure for some people and may have elevated cortisol levels at the outset of the sessions. This may cause a ceiling effect on the response. It is difficult to detect if this is the case. All but the fourth session in the Curtis (1976) study have the peak cortisol response at the beginning of the session. The fourth session's peak occurs at the 40 minute point before any treatment began. These peaks occur at the time closest to the insertion of the indwelling needle. This may indicate that the insertion procedure is anxiety provoking. The subsequent fall in cortisol could then represent two things: either habituation to the needle stimulus or once the needle has been inserted it ceases to cause anxiety. However this could also reflect the natural circadian decrease.

Fredrikson et al. (1985) propose that it may have been the habituation to continuous versus intermittent stimuli that caused the differing results. Evidence in support of this view comes from Natelson, Smith, Stokes & Root (1974) who found that intermittent stimulation in monkeys produced an increase in plasma cortisol levels while a study by Mason, Maher, Hartley, Mougey, Perlow et al. (1976) found habituation of plasma cortisol under continuous stimulation. This idea remains to be evaluated further.

Additional information to help understand the discrepancy in results comes from an a replication of the earlier study using the *in vivo* exposure paradigm.

Nesse et al. (1985) found a highly significant treatment effect on blood cortisol levels. This time the subjects were randomly assigned to two groups, one of which had their sessions in the early morning and the other in the early evening. The response of the morning group was minimal compared to the evening group. This study also demonstrated a lack of concordance amongst several hormonal indicators even though individually these hormone levels were well associated with the periods of phobic anxiety. Growth hormone, epinephrine, norepinephrine, insulin and cortisol all demonstrated strong responses to the exposure treatment but only norepinephrine was correlated with more than one other hormone.

Nesse et al. (1985) attributed the finding of positive cortisol results in this study to greater experimental control, increased number of data points decreasing the possibility of missing the response and to statistical analysis which took into account the varying baseline levels. This is an important point as individual cortisol levels vary considerably. One point about experimental control is that in exposing phobics to live stimuli, the stimuli cannot be kept constant across all subjects. Although the same animals may be used, their behaviour is difficult to predict. Therefore experimental procedures that utilise slide projections instead of live stimuli are in that respect more controlled but they may lose a considerable amount of anxiety provoking power.

It is interesting that Fredrikson et al. (1985) obtained such a clear cortisol response when their subjects were tested in the morning. This is possibly explained by the time difference between the two studies. Nesse et al. (1985) started their morning session subjects at 6am whereas Fredrikson et al. (1985) began their sessions at 8am. Evidence from Landon et al. (1984) shows there to be a dramatic decline in cortisol level between these hours. Although a fast decline in circadian level may temper an anxiety response at this time of day it may also lessen any ceiling effect.

Another project to examine cortisol reactivity to phobic anxiety was that of Regan, Brown and Howard (1991). Using non clinical phobic women with various simple phobias and analysing cortisol in urine, this study did not find a significant difference in cortisol levels between neutral and experimental sessions.

This is in contrast to two of the other studies using phobic populations but there are several methodolgical differences which may account for this.

Possible explanations for the apparent lack of cortisol response is that the subject population were non clinical phobics who were exposed to slides of their various phobic stimuli. This may not have produced as much anxiety as the *in vivo* exposure to clinical phobics in the Nesse et al. (1985) study. Although the Fredrikson et al. (1985) study used similar methodology it cannot be ascertained that the slides in both studies were equally anxiety provoking.

In comparing their results with those of Fredrikson et al. (1985), Regan et al. (1991) propose that it was the element of predictability in their methodology which caused the disparate results. In the earlier study the slides were presented intermittently with no warning whereas the latter study preceded their slides with a warning tone. Regan et al. (1991) argue that predictability allows some degree of control over a situation and that this might mediate a cortisol response.

Therefore the research to date on cortisol and anxiety has not produced consistent results. A major factor contributing to this may be that the subject populations have usually been heterogenous. This may mean that not all subjects in a study find the stimuli to be equally anxiety provoking. The studies that have used a homogenous subject pool such as the studies on phobic subjects, have been hindered by problems associated with blood or urine sampling techniques. It is hoped that these problems can be overcome in the present study by sampling the saliva cortisol levels of spider phobic women in response to a live spider stimulus. It is expected that the cortisol level will be higher on the phobic day than the neutral day and that the level will be higher after the introduction of the spider than at baseline.

Chapter Two

METHOD

2.1 Subjects

There were 10 female subjects, all non smokers who were recruited through advertisements around the University of Canterbury campus and in a local newspaper. The age range was between 18 and 35 with the average age being 23 years. The subjects met DSM III-R (American Psychiatric Association, 1987) criteria for simple phobia determined by interview using the Structured Clinical Interview for DSM III-R: Patient version (Spitzer et al., 1988; Appendix A). While it was desirable to include a separate control group, this was unfeasible for this study due to the cost of steroid analysis. Subjects were also screened for depression using the Beck Depression Inventory (Beck et al., 1961; Appendix B), with no subject scoring more than 6 on this scale; the mean score equalling 3.3 and ± 2.2. Participants completed the Questionnaire Dimensions of Spider Phobia (DSPQ),(Watts & Sharrock, 1984; Appendix C) with a mean score of 26.4 and ± 5.9 and the Spider Questionnaire (SPQ), (Lang, Melamed & Hart, 1970; Appendix D) with an average score of 20.4 and ± 4.2.

The subjects were all in good health and were not taking any medication. Subjects were not screened for use of the contraceptive pill as this would have made subject recruitment too difficult for the realms of this study. The effect of taking such medication on cortisol secretion has not been firmly established with contradictory results and is more problematic when absolute values are being compared (Kirschbaum & Hellhammer, 1989).

The experimental procedure was described in full to all subjects and informed consent was obtained (Appendix E). Each subject received $10.00 for their participation.

2.2 Procedure

Subjects each attended a total of three sessions; the first was an assessment session when they completed the above questionnaires and were familiarised with the surroundings. The blood pressure and saliva procedures were practised. The other two sessions consisted of a neutral control session where the stimulus was a woman's dress watch and the experimental session where the stimulus was a large, live, nursery web spider sealed in a plastic jar. The spider was approximately 6 cm in diameter (measured leg to opposite leg), dark brown and hairy. The order of the sessions were counterbalanced and subjects were informed as to which session they would receive first in order to eliminate the element of surprise or relief.

The women were instructed not to have food or caffeine in the hour prior to 9 am when the sessions began. On arrival at the laboratory, subjects rinsed their mouths with water to remove any debris before being made comfortable and being fitted with an Omron automatic blood pressure machine. Before beginning the baseline period the full procedure was explained again and any uncertainties clarified.

During the ten minute baseline period, blood pressure, heart rate and subjective units of distress (SUDS) were taken every two minutes. Feelings of distress were recorded on an 8 point scale with 0 representing no anxiety at all and 8 representing feeling extremely anxious. A saliva sample was collected at four minutes by getting the subject to insert a cotton dental roll on the tongue and making a chewing motion for one minute to stimulate saliva production.

After the baseline period, the subject was informed that the experimenter was leaving the room to collect the cue for that session. On return to the room the stimulus was placed in the subject's hand and she was instructed to focus her attention on it. Not all subjects were able to hold the spider straight away and one subject still could not pick the jar up at the end of the stimulus period so it was left resting on the arm of the subject's chair. Blood pressure, heart rate and SUDS were taken immediately and then at three minute intervals while saliva samples were collected three minutes after the introduction of the stimulus and at 21

minutes. Thus a total of three saliva samples were taken. The stimulus was removed from the room after four minutes.

At the end of the session, the saliva samples were frozen for later analysis at the Canterbury Health Steroid Laboratory using an in-house radioimmunoassay method. Subjects were shown their data and debriefed at the completion of the second experimental session.

Chapter Three

RESULTS

One subject was eliminated from the analysis because an inadequate amount of saliva was obtained for an accurate assessment of cortisol. Another subject was removed from the analysis due to their scores being more than 2.5 standard deviations from the mean. Subject demographics are presented in Table 1. Raw subject data are presented in graph form for each variable in appendices F to J.

	Subject	Age	BMI	BDI	DSPQ	SPQ
	1	23	22.5	3	15	10
	2	21	22.3	3	34	22
	3	31	29.3	0	25	23
	4	20	21.2	5	33	25
	5	18	21.3	1	28	21
	6	30	19.7	6	25	21
	7	25	19.0	6	27	22
	8	19	18.4	3	26	19
	9	25	24.4	1	19	18
	10	18	21.5	5	32	23
Mean		23	22.0	3.3	26.4	20.4
s.d.		4.7	3.1	2.2	6.0	4.2

Table 1 : Demographic Data

Data were analysed by a 2X2 repeated measures analysis of variance with two within factors; condition (spider and neutral) and time (baseline, 3min and 21min). Examining salivary cortisol, there was no main effect for condition

($F(1,14)= 0.06$, n.s.). There was a significant main effect for time, ($F(2,13) = 11.3$, $p < 0.01$), indicating a significant decrease in cortisol over time. There was no significant interaction effect between condition and time, ($F(2,13) = 0.11$, n.s.). This demonstrates a significant decrease in cortisol over time which occurred under both conditions.

There was no main effect for condition on systolic blood pressure, ($F(1,14) = 1.77$, n.s.), nor was there a significant main effect for time, ($F(2,13) = 2.71$, n.s.). However there was a significant interaction effect, ($F(2,13) = 4.21$, $p< 0.05$). On phobic days, systolic blood pressure was elevated, but only immediately after the introduction of the spider, ($F(1,14) = 4.04$, $p< 0.05$). There was a quick recovery of normal systolic blood pressure after this.

There were no significant main effects for diastolic blood pressure either for condition ($F(1,14) = 0.60$, n.s.) or time ($F(2,13) = 0.51$, n.s.). There was no significant interaction effect of condition and time showing that diastolic blood pressure did not change appreciably over time regardless of whether it was a phobic or neutral session, ($F(2,13) = 1.09$, n.s.).

Although there was no significant main effect of condition on heart rate, ($F(1,14) = 2.02$, n.s.), there was a significant main effect for time, ($F(2,13) = 5.41$, $p< 0.01$) and a significant interaction effect, ($F(2,13) = 6.62$, $P< 0.01$). Therefore heart rates were only higher during the phobic condition at certain points in time; again most noticeably immediately after the introduction of the spider, ($F(1,14) = 9.35$, $p<0.01$).

As was expected, there were highly significant differences in subjective units of distress, including a main effect of condition, ($F(1,14) = 53.33$, $p< 0.001$); of time, ($F(2,13) = 19.99$, $p< 0.001$) and in the interaction of condition and time, ($F(2,13) = 17.65$, $p< 0.001$). This demonstrates that subjects were more anxious in the phobic session than in the neutral session, particularly after the introduction of the spider.

Reactivity Within Session

It was possible that the differing baseline levels may have accounted for the absence of a higher cortisol response on the phobic day. To explore this explanation differences between baseline levels and the level after the introduction of the cue were calculated. It was expected that cortisol levels would increase at the 3 minute period when the spider was introduced but this was not confirmed. There was no significant difference in reactivity in the phobic session compared to the neutral session using paired t-tests; ($t(7) = 0.24$, n.s.).

There was significantly higher systolic blood pressure reactivity during the phobic condition than the neutral one, ($t(7) = 2.83$, $p < 0.05$); but there was no difference in the reactivity of diastolic blood pressure between conditions, ($t(7) = 1.49$, n.s.).

Although there was no significant difference in heart rate reactivity across conditions, ($t(7) = 1.45$, n.s.), there was a highly significant difference in reactivity of subjective anxiety, ($t(7) = 5.84$, $p < 0.001$).

Order Effects

While there was no significant effect of condition on cortisol reactivity, there appeared to be a significant effect for the order in which the subjects received the sessions, ($F(1,14) = 12.28$, $p < 0.01$). Subjects who received their spider session first had a mean *increase* in cortisol of 2.25 nmol (s.d. 4.34) compared to those subjects who received the spider session second whose mean *decrease* was 5.25, s.d. 4.03. Those subjects who received the neutral session first had a mean *increase* of 3.0 nmol, s.d. 6.5 in response to the watch, whereas in the case of subjects who experienced the neutral session second, the change in cortisol was a mean *decrease* of 7.75 nmol, s.d. 6.07. Therefore, subjects appeared to respond

by an increase in cortisol to the entry of either cue in the first session but not the second, indicating a possible novelty effect.

There were no other effects of order on any of the other variables; systolic ($F(1,14) = 0.40$, n.s.); diastolic ($F(1,14) = 0.23$, n.s.); heart rate ($F(1,14) = 0.06$, n.s.); or SUDS ($F(1,14) = 1.80$, n.s.).

Product Moment Correlations Between Physiological Measures.

In accordance with previous research, not all physiological measures correlated together. As can be seen from Table 3 variables which correlated significantly with each other were; diastolic and systolic blood pressure; systolic blood pressure with heart rate; diastolic with heart rate, and heart rate with SUDS. Cortisol, the main variable of interest did not correlate significantly with any other variable. These results provide further evidence of desynchrony amongst response channels.

Table 2 : Pairwise Correlations of the Reactivity Amongst Variables.

Variable 1	Variable 2	r	p
Cortisol	Systolic	0.17	n.s
Cortisol	Diastolic	0.04	n.s
Cortisol	Heart Rate	0.08	n.s
Cortisol	SUDS	0.07	n.s
Systolic	Diastolic	0.75	<0.001
Systolic	Heart Rate	0.74	<0.001
Systolic	SUDS	0.30	n.s
Diastolic	Heart Rate	0.75	<0.001
Diastolic	SUDS	0.21	n.s
Heart Rate	SUDS	0.49	<0.05

Chapter Four

Discussion

The most noteworthy finding of the present study was that subjects did not display a marked cortisol response to the presence of the spider only but did show increases in cortisol levels in response to the first cue, whether it was the spider or the neutral cue. While saliva cortisol did not seem to discriminate periods of anxiety several other variables did. Heart rate and systolic blood pressure appeared to be the most reliable physiological measures, with heart rate obtaining a good correlation with subjective reports of distress. The failure in this case for subjects to exhibit a cortisol response to the phobic stimulus may be due to several reasons.

Some other experiments which have used phobic stimulation have found a cortisol response. This may be because, in the case of Nesse et al. (1985), the subject population were clinical phobics receiving *in vivo* exposure during the experiment. This is presumably more anxiety provoking than using non-clinical subjects in a situation where they knew they would not actually have to touch the spider. The subjects who participated in the current study were perhaps not at the extreme end of spider phobia although most said they would not have taken part if the spider had not been sealed in the jar. Several phobics would not take part because even this situation was expected to be too frightening for them. Of those that volunteered to take part, one could not complete the phobic session because the anxiety was too intense. So it seems that although the subjects in this study may not have been quite as seriously affected by their phobia as those in the Nesse et al. (1985) study because they had not sought treatment, they were still very anxious about the actual procedure used.

The difficulty in using live stimuli is that the experiment is left open to a certain lack of control. In this case the spider, although it was alive, remained perfectly motionless while being viewed by most subjects - so much so that one

subject actually believed it to be dead. With many spider phobics it is the spider's movement which they find repulsive, so the lack of movement in this case may have led them to be less anxious than they otherwise would be (Bennett-Levy & Marteau, 1984; Merckelbach, van den Hout & van den Molen, 1987). Another characteristic of spider phobia is that the phobics find spiders to be particularly unpredictable in their behaviour (Arntz, Lavy, van den Berg & van Rijsoort, 1993). This element was also eliminated in this experiment by the spider's confinement.

While the experimental paradigm used in this study could be said to be less anxiety provoking than that used by Nesse et al. (1985), it would be expected to be more anxiety provoking than those studies which have used slide presentations. In the two studies reviewed earlier that employed the use of phobic slides, different results were obtained. In the study by Fredrikson et al. (1985) a clear response in cortisol was observed. Two major differences in methodology may account for the disparate results. Fredrikson et al. (1985) used urine sampling while the current study used saliva cortisol sampling. It is possible that a cortisol response was missed by sampling too soon after the introduction of the spider. This explanation seems unlikely however, because our third cortisol sample at 21 minutes after the introduction of the spider was still not significantly different between the phobic or neutral days even though the half life of cortisol in blood (and therefore saliva) is approximately one hour or more (Peters et al. 1984; Hiramatsu, 1981) and cortisol has been shown to transfer from the blood to saliva within one minute (Vining et al., 1983; Walker et al, 1984). Also Regan et al. (1991) used urine sampling to phobic slides and did not find a response.

Another possibility is that the stimulation period in this study was too short to elicit activation of the hypothalamic-pituitary-adrenal axis. The total time spent with the spider was four minutes compared with a total ten minute period of intermittent stimulation in the Fredrikson et al. (1985) study. Regan et al. (1991), the other study using slide projections that did not find an increase in cortisol, had a total stimulation period of approximately seven minutes which again might not have been sufficient. Other evidence which may lend support to the hypothesis that the length of stimulation may have been too short comes from those studies which

employ the use of suspense films to provoke anxiety. Hubert and de Jong-Meyer (1989), Hellhammer et al. (1986) and Brown and Heninger (1976) are all studies which have found positive cortisol responses to films which are on average 90 minutes in duration. Therefore it would be useful to know whether the duration of stimulation is critical in determining a cortisol response. However as the current study used phobic anxiety to the feared stimulus one would expect the phobic reaction to be much faster than this. It is possible that the phobic reaction is being mediated by the subject's knowledge of the degree of control in the situation, a factor posited by Regan et al. (1991). In the present study, subjects may have felt reasonably comforted by the fact the spider was confined and therefore two major elements of the fear of spiders (ie. their movement and unpredictability) were eliminated. Although there was a significant difference in subjective anxiety between conditions, not all of the subjects actually rated their anxiety at the maximum level indicating that they did not find the situation maximally threatening.

As the experimental sessions in this study were conducted at 9 am it is possible that a potential cortisol response was blunted by a ceiling effect as cortisol levels in the early morning are reasonably high. The average baseline cortisol level on both days was 20.5 nmol, ± 5.9 (range of 9-30) whereas data from Guechot et al. (1982) show the mean cortisol level of 45 women at 8 am to be 14 nmol, ±7.1 (range of 5.1-25.5). Vining & McGinley. (1986) demonstrated mean levels in a mixed group to be 13 nmol (range of 6-21) at 9 am and even at 6 am the mean of their subjects' was slightly lower than in the current study at 18 nmol. Higher cortisol levels are possible but are usually associated with states of depression or in specific disorders such as Cushing's Syndrome (Carpenter & Gruen, 1982). While no firm conclusions can be made from comparing these figures because different RIA kits may have contributed to the variability, it appears as though the baseline levels were considerably high meaning that there might not have been sufficient 'room' left to show a response.

If the baseline levels in the present study are truly elevated and it is not due to the type of immunoassay then it must be considered that subjects are either responding in anticipation of the event or to the novelty of it. It would be

reasonable to assume that subjects would arrive in an anxious state to their phobic session, but if cortisol levels are a true reflection of anxiety, then subjects were anxious during the baseline period of both sessions. Considering that other indices of anxiety, namely SUDS, blood pressure and heart rate were not elevated during the baseline period of the neutral session, it is reasonable to conclude that it is not purely anxiety that is present. In fact a significant order effect was found for cortisol indicating that subjects did experience elevations in cortisol levels in response to novelty rather than to anxiety per se. Attempts had been made to avoid novelty effects by having a non-experimental session with each subject in the actual experimental room where they practised the dental roll procedure and experienced the taking of blood pressure. However it may be advisable in future to conduct more extensive simulations of the experimental procedure to more fully control for novelty. It must be said however that it is virtually impossible to eliminate novelty effects without practising the full procedure with the actual stimuli, in which case the risks of desensitisation and habituation come into play.

Novelty effects on the cortisol response have been evident in other research. Data from Curtis et al. (1976) indicated higher cortisol levels throughout the first two control sessions when no *in vivo* exposure took place at all than in the exposure sessions themselves. In the two experimental sessions cortisol was higher at the beginning of the session than during the actual exposure which could be interpreted either as continuing novelty, a circadian rhythm effect or as anxiety induced by venipuncture. In their second study utilising the exposure paradigm, Nesse et al. (1985) did find a significant increase in cortisol in response to the exposure treatment but there is also evidence of a cortisol response to novelty or venipuncture in the first control session but not in the last control session held after the two treatment sessions.

Fredrikson et al. (1985) did not appear to have any elevations in cortisol other than to the phobic slide presentation, however their data were not presented over time because of the delay necessary in urine sampling. Their data may be slightly misleading because of the difference in baseline levels between the phobic and control days. The mean baseline level on the neutral day was considerably

higher at 857.3 pmol/min compared to 559.0 pmol/min on the phobic day. If there are ceiling effects to consider, especially as this study was conducted in the morning, percentage increases from the baseline level may favour the session with the lower baseline reading making increases appear larger than what they were.

In Brown and Heninger's (1975) study, cortisol levels were higher in the control film which was always shown first than in either the sexually arousing film or the suspense film. Again it is difficult to determine whether this is due to the novelty of the situation or to a reaction to venipuncture.

A major difficulty arises when trying to determine exactly what causes the adrenocortical response. Debate has arisen over whether it is caused by uncertainty (brought on by the novelty of the situation) or by negative emotional states (Levine, 1985; Rose,1980).

Gunnar et al. (1989) tested the effect of novelty by subjecting newborn babies to two discharge examinations on consecutive days. It was found that the babies' cortisol levels were elevated after the first examination but not the second although behavioural indices of distress were equal on both days. The authors interpreted this as habituation of the adrenocortical response. It should be highlighted, however, that novelty effects and habituation of the physiological response are not necessarily the same thing. There are two points of potential impact on the adrenal system. The first is activation of the system by a stimulus. Depending on how this stimulus is perceived, threatening or non-threatening, then activation of the adrenal cortex to release cortisol may or may not occur. Novelty exerts an influence over the first point in the chain. Habituation may occur when the stimulus is still perceived as potentially threatening but on repeated presentation of the stimulus the adrenal system has become exhausted and no longer exhibits a response. In this situation it is possible that the situation failed to make an impact on the HPA axis the second time, not that the adrenocortical system has ceased to respond to the same stimulus. It would be very difficult to assess whether habituation of the physiological response actually occurred without continued exposure to the same stimulus in which case novelty is lost at the same time.

To test whether novelty was the only condition necessary to provoke a cortisol response, Hertsgaard, Gunnar, Larson, Brodersen & Lehman (1992) tested 31 babies inexperienced in swimming and 14 babies experienced in swimming in a pleasant swimming situation. If novelty was the major factor then cortisol levels should have increased more in the novice babies after swimming, however both groups showed an equal decline in cortisol after swimming. Therefore it was concluded that novelty in itself was not sufficient and that the emotional arousal was a major mediating factor.

However it may be the intensity of the emotion not the type of emotion itself which determines a cortisol response. For instance elevations in cortisol have been found when positive emotions have been induced by having subjects watch a funny film and that the funnier and more interesting the film, the more cortisol was secreted (Hubert, Moller & de Jong-Meyer, 1993).

While the results of the current study show cortisol to be a rather insensitive index of phobic anxiety, in accordance with previous research, the other dependent measures, particularly heart rate and systolic blood pressure proved to be more sensitive. Both of these measures were significantly different on the phobic day particularly immediately following the introduction of the spider. They also both showed reliable decrements once the spider had been removed from the experiment.

The results provided further evidence of desynchrony as described by Hodgson and Rachman (1974) in that few of the dependent measures varied with each other. The best indicator to concur with subjective report was heart rate, which in turn was in keeping with changes in systolic blood pressure. Cortisol did not vary with any other variable although this may be due to measurement artefacts.

Summary

There are many benefits to using salivary cortisol sampling to test adrenocortical functions. It allows pain free, multiple samples to be taken without having to incur the costs of specialised medical personnel or equipment. The procedure is simple enough to be carried out by subjects in their own homes giving researchers access to data obtained in a more naturalistic setting. It does not confound the results by causing anxiety as is the case with venipuncture and is less embarrassing for subjects than providing urine samples. For these reasons subject recruitment is also easier. In addition, it is easier to obtain samples from children.

However it appears that at least at this stage, the usefulness of salivary cortisol as an assessment tool in phobic anxiety is limited by several factors.

1. The need to clarify whether the cortisol response is due to the actual anxiety or to the novelty of the situation. Of course it is highly feasible that both factors are at work in which case more assessment sessions may help but this may cause the subject to desensitise to the stimulus.

2. The need to be sure that a decrease in the response is due to a corresponding decrease in anxiety and not physiological habituation. This cannot be inferred by correlating with subjective reports as the two measures often do not vary with each other. Therefore research into habituation of the cortisol response in humans (both adults and children) is required. This will need to examine the effects of stimulus intensity, duration and frequency.

3. That before saliva cortisol measures could be useful as a measure of any individual's anxiety, extensive baseline measures at the appropriate time of day would be required to account for the considerable interindividual variability of this physiological system.

4. The need to know how the cortisol response may differ between general physiological responders or non-responders in conjunction with different situations and/or different anxiety disorder subtypes.

5. The fact that cortisol appears to respond to arousal other than anxiety. This may point to non-specificity and therefore other potential sources of stimulation need to be carefully excluded.

Therefore much research has to be done before the analysis of saliva cortisol can be used as a definitive measure in phobic anxiety or in other anxiety disorders generally. On a positive note the development of saliva cortisol sampling instead of blood or urine sampling has been proven to be a major advance.

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SCID-P (W/PSY SCREEN) (Version 1.0) | Simple Phobia | Anxiety Disorders F.10

Simple Phobia

Are there any other things that you have been especially afraid of, like flying, heights, seeing blood, closed places, or certain kinds of animals or insects? What are you afraid could happen when _____?	**SIMPLE PHOBIA CRITERIA** A. A persistent fear of a circumscribed stimulus (object or situation), other than of having a panic attack (as in Panic Disorder) or of humiliation or embarrassment in certain social situations (as in Social Phobia). NOTE: DO NOT INCLUDE FEARS THAT ARE PART OF PANIC DISORDER WITH AGORAPHOBIA OR AGORAPHOBIA WITHOUT HISTORY OF PANIC DISORDER. PHOBIC OBJECT(S) OR SITUATION(S). Check: ____ animals ____ heights ____ closed spaces ____ blood/injury ____ other: _____	? 1 2 3 Go to "Obsessive Compulsive Disorder," F.12	28 29 30 31 32 33
IF UNCLEAR WHETHER FEAR WAS CLINICALLY SIGNIFICANT: How much did _____ interfere with your life? (Is there anything you've avoided because of being afraid of _____?) IF DOES NOT INTERFERE WITH LIFE: How much has the fact that you were afraid of _____ bothered you?	B. The fear of the avoidant behavior significantly interferes with the person's normal routine or with usual social activities or relationships with others, or there is marked distress about having the fear.	? 1 2 3 Go to "Obsessive Compulsive Disorder," F.12	34
Did you always feel anxious when you (CONFRONTED PHOBIC STIMULUS)?	C. During some phase of the disturbance, exposure to the specific phobic stimulus (or stimuli) almost invariably provokes an immediate anxiety response.	? 1 2 3 Go to "Obsessive Compulsive Disorder," F.12	35
Did you go out of your way to avoid _____? (Are there things you didn't do because of this fear that you would otherwise have done?) IF NO: How hard (is/was) it for you to _____?	D. The object or situation is avoided, or endured with intense anxiety.	? 1 2 3 Go to "Obsessive Compulsive Disorder," F.12	36
Did you think that you were more afraid of _____ than you should have been (or than made sense)?	E. The person recognizes that his or her fear is excessive or unreasonable.	? 1 2 3 Go to "Obsessive Compulsive Disorder," F.12	37

? = Inadequate information 1 = absent or false 2 = subthreshold 3 = threshold or true

(W/PSY SCREEN) (Version 1.0)	Simple Phobia	Anxiety Disorders F.11	
IF NOT ALREADY CLEAR: RETURN TO THIS ITEM AFTER COMPLETING SECTION ON OBSESSIVE COMPULSIVE DISORDER.	F. The phobic stimulus is unrelated to the content of the obsessions of Obsessive Compulsive Disorder or to the trauma of Posttraumatic Stress Disorder.	? 1 2 3 — Go to "Obsessive Compulsive Disorder," F.12	38
	SIMPLE PHOBIA CRITERIA A, B, C, D, E, AND F ARE CODED "3"	? 1 3 — Go to "Obsessive Compulsive Disorder," F.12 — Simple Phobia	39
CHRONOLOGY			
IF UNCLEAR: During the past month, have you been bothered by (SIMPLE PHOBIA)?	Has met criteria for Simple Phobia during past month	? 1 3	40
When were you last bothered by (SIMPLE PHOBIA)?	Number of months prior to interview when last had a symptom of Simple Phobia	— — —	41-43
"Past Five Years"			
During the past five years, how much of the time has (SX OF SIMPLE PHOBIA) interfered with your life or bothered you a lot?	Approximate percentage of time during past five years that symptoms of Simple Phobia either interfered with functioning or caused marked distress		
Would you say . . . [CODE DESCRIPTIONS]?	1 Not at all (0%)		44
	2 Rarely (e.g., 5–10%)		
	3 A significant minority of the time (e.g., 20–30%)		
	4 About half the time		
	5 A significant majority of the time (e.g., 70–80%)		
	6 Almost all the time (e.g., 90–100%)		
	9 Unknown		
How old were you when you were first bothered by (SXS OF SIMPLE PHOBIA)?	Age at onset of Simple Phobia	— —	45-46

? = Inadequate information 1 = absent or false 2 = subthreshold 3 = threshold or true

BECK INVENTORY

Name_____ Date_____

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group which best describes the way you have been feeling the PAST WEEK, INCLUDING TODAY! Circle the number beside the statement you picked. If several statements in the group seem to apply equally well, circle each one. **Be sure to read all the statements in each group before making your choice.**

1 0 I do not feel sad.
1 I feel sad.
2 I am sad all the time and I can't snap out of it.
3 I am so sad or unhappy that I can't stand it.

2 0 I am not particularly discouraged about the future.
1 I feel discouraged about the future.
2 I feel I have nothing to look forward to.
3 I feel that the future is hopeless and that things cannot improve.

3 0 I do not feel like a failure.
1 I feel I have failed more than the average person.
2 As I look back on my life, all I can see is a lot of failures.
3 I feel I am a complete failure as a person.

4 0 I get as much satisfaction out of things as I used to.
1 I don't enjoy things the way I used to.
2 I don't get real satisfaction out of anything anymore.
3 I am dissatisfied or bored with everything.

5 0 I don't feel particularly guilty.
1 I feel guilty a good part of the time.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6 0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7 0 I don't feel disappointed in myself.
1 I am disappointed in myself.
2 I am disgusted with myself.
3 I hate myself.

8 0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10 0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11 0 I am no more irritated now than I ever am.
1 I get annoyed or irritated more easily than I used to.
2 I feel irritated all the time now.
3 I don't get irritated at all by the things that used to irritate me.

12 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13 0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions than before.
3 I can't make decisions at all anymore.

14 0 I don't feel I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

15 0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

16 0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17 0 I don't get more tired than usual.
1 I get tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

18 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19 0 I haven't lost much weight, if any, lately.
1 I have lost more than 5 pounds. I am purposely trying to lose wei
2 I have lost more than 10 pounds. by eating less. Yes____ No___
3 I have lost more than 15 pounds.

20 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains; or upset stomach; or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think about anything else.

21 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

APPENDIX C

Questionnaire dimensions of spider phobia.

1.	Do you check the lounge for spiders before sitting down?	Y / N
2.	Can you deal effectively with spiders yourself when you find them?	Y / N
3.	Are spiders insects?	Y / N
4.	Do you sometimes dream about spiders?	Y / N
5.	Do you ever make plans in case you come across a spider?	Y / N
6.	Do you sometimes look at the corners of the room for spiders?	Y / N
7.	Do you get other people to get rid of spiders when you find them?	Y / N
8.	When imagining a spider, is it always the same one or kind?	Y / N
9.	Do you think a lot about spiders?	Y / N
10.	Would you know how to cope with spiders in the bath?	Y / N
11.	When watching television, would you notice a spider crawling across the floor elsewhere in the room?	Y / N
12.	Do spiders have six legs?	Y / N
13.	Do you sometimes use a book or a newspaper to deal with a spider?	Y / N
14.	Do you worry more about spiders than most people?	Y / N
15.	Do you feel a lot more secure if someone else is in the house, in case you come across a spider?	Y / N
16.	When you imagine a spider, can you see parts of it in great detail?	Y / N
17.	Do you check the bedroom for spiders before going to sleep?	Y / N
18.	When you find a spider in a room, would you avoid going in that room until someone else had removed it?	Y / N
19.	Do you ever find yourself thinking about spiders for no reason?	Y / N
20.	Are spiders solely meat eaters?	Y / N
21.	Would you get help if you came across a spider?	Y / N
22.	Do you ever lie in bed at night and listen out for spiders?	Y / N
23.	If you *thought* you saw a spider would you go for a close look?	Y / N
24.	Do you sometimes find it an effort to keep thoughts of spiders out of your mind?	Y / N
25.	Would your mind be a lot easier if spiders didn't exist?	Y / N
26.	Have you a good idea whereabouts spiders are likely to appear?	Y / N
27.	Are you always on the lookout for spiders?	Y / N
28.	Do you often think about particular parts of spiders - for example the fangs?	Y / N
29.	If you find a spider in the bath, would you, say use a shower to wash the spider down the plughole?	Y / N
30.	Are you sometimes distracted by thoughts of spiders?	Y / N

31. Have you a "plan for action" in case you find a spider in the kitchen? Y / N
32. Are you sometimes haunted by thoughts of spiders? Y / N
33. Do you make very certain there are no spiders around before taking a bath? Y / N
34. If you discover a spider in the room, do you leave the room straight away? Y / N
35. When watching television do you think more about the danger of there being a spider in the room than about the programme? Y / N
36. When you see a spider, does it take a long time to get it out of your mind? Y / N
37. Do you know when (what time of the year) you are likely to come across a spider? Y / N
38. Do you sometimes sense the presence of a spider without actually seeing it? Y / N
39. Are you slightly scared to enter a room, say a toilet, where spiders have been in the past? Y / N
40. If there's a spider in the house, are you the most likely person to find it? Y / N
41. Have you had nightmares about spiders? Y / N
42. Would you think about using a broom to deal with a spider in the kitchen? Y / N
43. Can you spot a spider out of the corner of your eye? Y / N

APPENDIX D

SPIDER QUESTIONNAIRE.

1. I avoid going to parks or on camping trips because there may be spiders about. T / F
2. I would feel some anxiety holding a toy spider in my hand. T / F
3. If a picture of a spider crawling on a person appears on the screen during a motion picture, I turn my head away. T / F
4. I dislike looking at pictures of spiders in a magazine. T / F
5. If there is a spider on the ceiling over my bed, I cannot go to sleep unless someone kills it for me. T / F
6. I enjoy watching spiders build webs. T / F
7. I am terrified by the thought of touching a harmless spider. T / F
8. If someone says that there are spiders anywhere about, I become alert and on edge. T / F
9. I would not go down to the basement to get something if I thought there might be spiders down there. T / F
10. I would feel uncomfortable if a spider crawled out of my shoe as I took it out of the wardrobe to put it on. T / F
11. When I see a spider, I feel tense and restless. T / F
12. I enjoy reading articles about spiders. T / F
13. I feel sick when I see a spider. T / F
14. Spiders are sometimes useful. T / F
15. I shudder when I think of spiders. T / F
16. I don't mind being near a harmless spider if there is someone there in whom I have confidence. T / F
17. Some spiders are very attractive to look at. T / F
18. I don't believe anyone could hold a spider without some fear. T / F
19. The way spiders move is repulsive. T / F
20. It wouldn't bother me to use a long stick touch a dead spider . T / F
21. If I came upon a spider while cleaning , I would probably run. T / F
22. Spiders , more than any other animal, make me afraid. T / F
23. I would not want to travel to Mexico or Central America because of the greater prevalence of tarantulas. T / F
24. I am cautious when buying fruit because bananas may attract spiders. T / F

25. I have no fear of non-poisonous spiders. T / F

26. I wouldn't take a course in biology if I thought I might have to handle live spiders. T / F

27. Spider webs are very artistic. T / F

28. I think that I'm no more afraid of spiders than the average person. T / F

29. I would prefer not to finish a story if something about spiders was introduced into the plot. T / F

30. Even if I was late for a very important appointment, the thought of spiders stop me from taking a shortcut under a bridge, or other type of tunnel. T / F

31. Not only am I afraid of spiders but millipedes and caterpillars make me feel anxious. T / F

APPENDIX E

University of Canterbury *Department of Psychology*

Consent Form; Salivation and Anxiety

Reason for Research

This study is designed to examine the human salivary response to different insect cues. We will be studying women with fears of spiders as well as women who are not fearful of spiders. We are interested in how salivation differs in response to both spiders and a neutral cue. We will be looking at how much of a hormone called cortisol is present in your saliva. You have been invited to participate in this research because you have indicated a fear of spiders or the absence of such a fear, are a nonsmoker, are physically healthy and are medication free.

Your Tasks in this Research

After the initial screening during which you will be asked several questions about fears of spiders and to complete a self-report form, you will be asked to participate in two short laboratory sessions on two different days. Each session should take approximately 45 minutes. On one of the occasions, you will be asked to hold a jar with a spider in it and on the other occasion a watch. You will be asked to insert one dental roll in your mouth, on the tongue. We will also monitor your blood pressure and heart rate using a digital blood pressure pulse monitor with which we will take readings every two minutes. We will also ask you how anxious you are feeling. We will ask you to remove the dental roll and place in a plastic tube for collection. They will then be frozen and cortisol will be extracted.

Risks Associated with Participation

The only risk associated with this procedure is having to hold a spider in a jar. You may find this uncomfortable. You will insert and remove the dental rolls

yourself. Towlettes will be provided for handwashing prior to insertion. This procedure is familiar to most people from visits to the dentist's office.

Confidentiality

Complete confidentiality is assured. Numbers not names will be used on all experimental materials. When results of this research are published, no identifying information will be provided.

Voluntary Participation

Your participation in this research is completely voluntary. If at any time you choose to discontinue participation, you are free to do so at no cost to you and any data collected will be returned to you or destroyed.

Time Required

You will spend approximately 15 minutes in the lab today and 45 minutes on two separate occasions for the experimental procedure. You will be paid $10.00 for your participation.

Name of Researchers

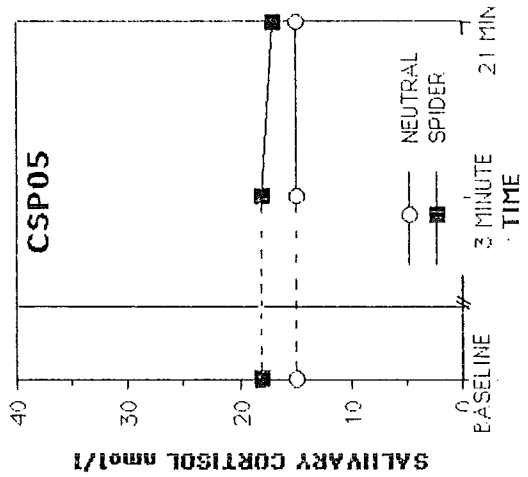
Cynthia M. Bulik, Ph.D, Lecturer in Psychology (364 2169)
Frances A. Carter, Dip. Clin. Psyc., Research Officer (337 7695)
Rachel Lawson, Research Assistant (366 7001 x 7987)
Lorraine Rutland, Research Student (355 3170)

Voluntary Consent

I have read the contents of this consent form and understand them completely. I also understand the risks and benefits associated with participation in this research. I realise that I am free to withdraw consent at any time and discontinue participation at any time.

Signature of Participant	Date
Signature of Investigator	Date

APPENDIX E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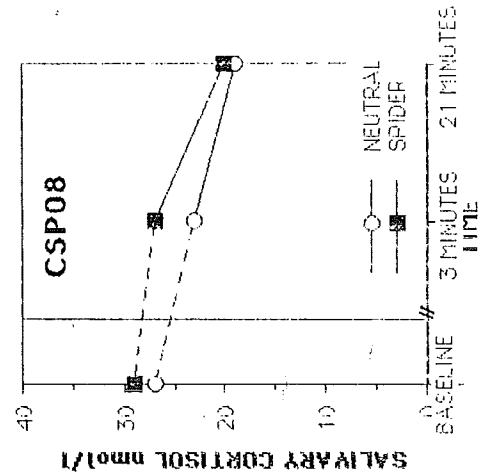
40
30
20
10
0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TIME
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30
20
10
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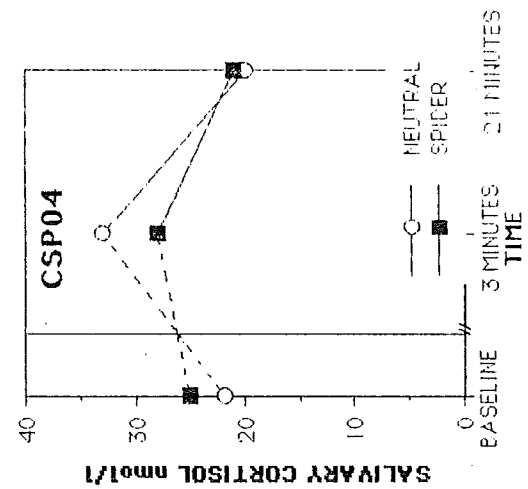
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TIME
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30
20
10
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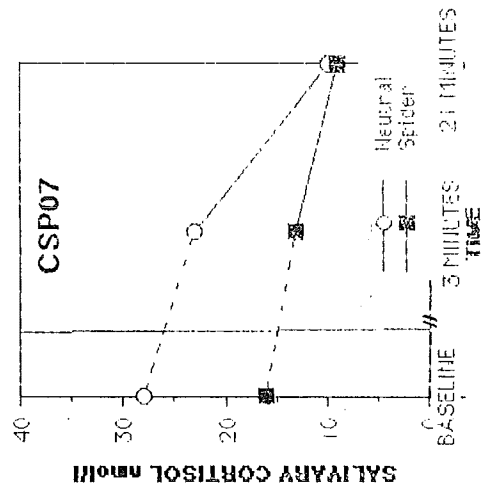
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Spider
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TIME
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30
20
10
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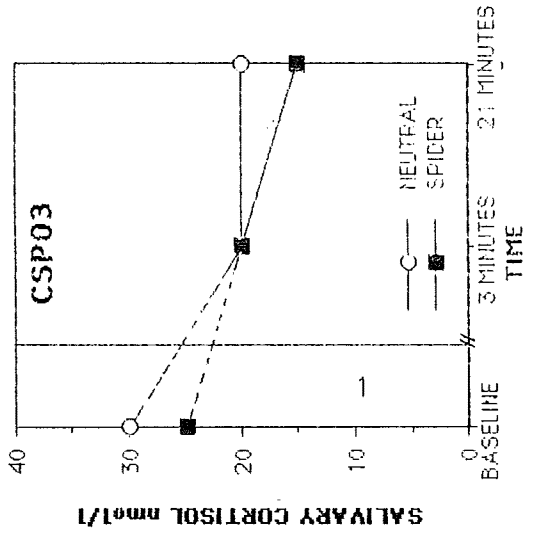
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TIME
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30
20
10
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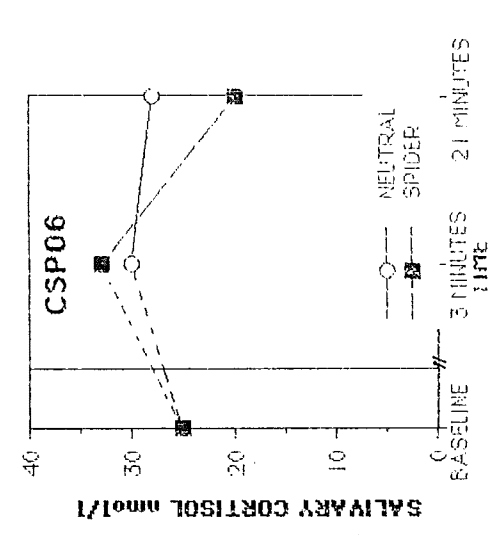
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TIME
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30
20
10
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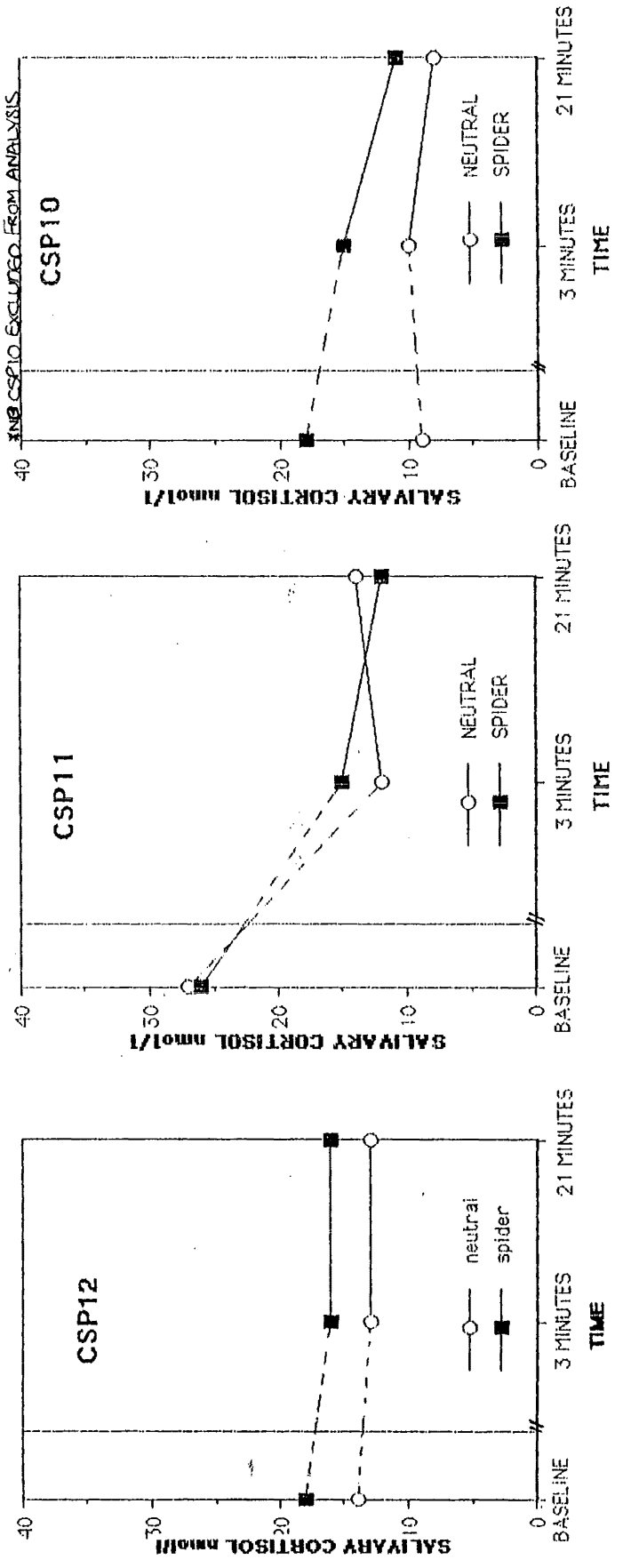
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CSP11
CSP12
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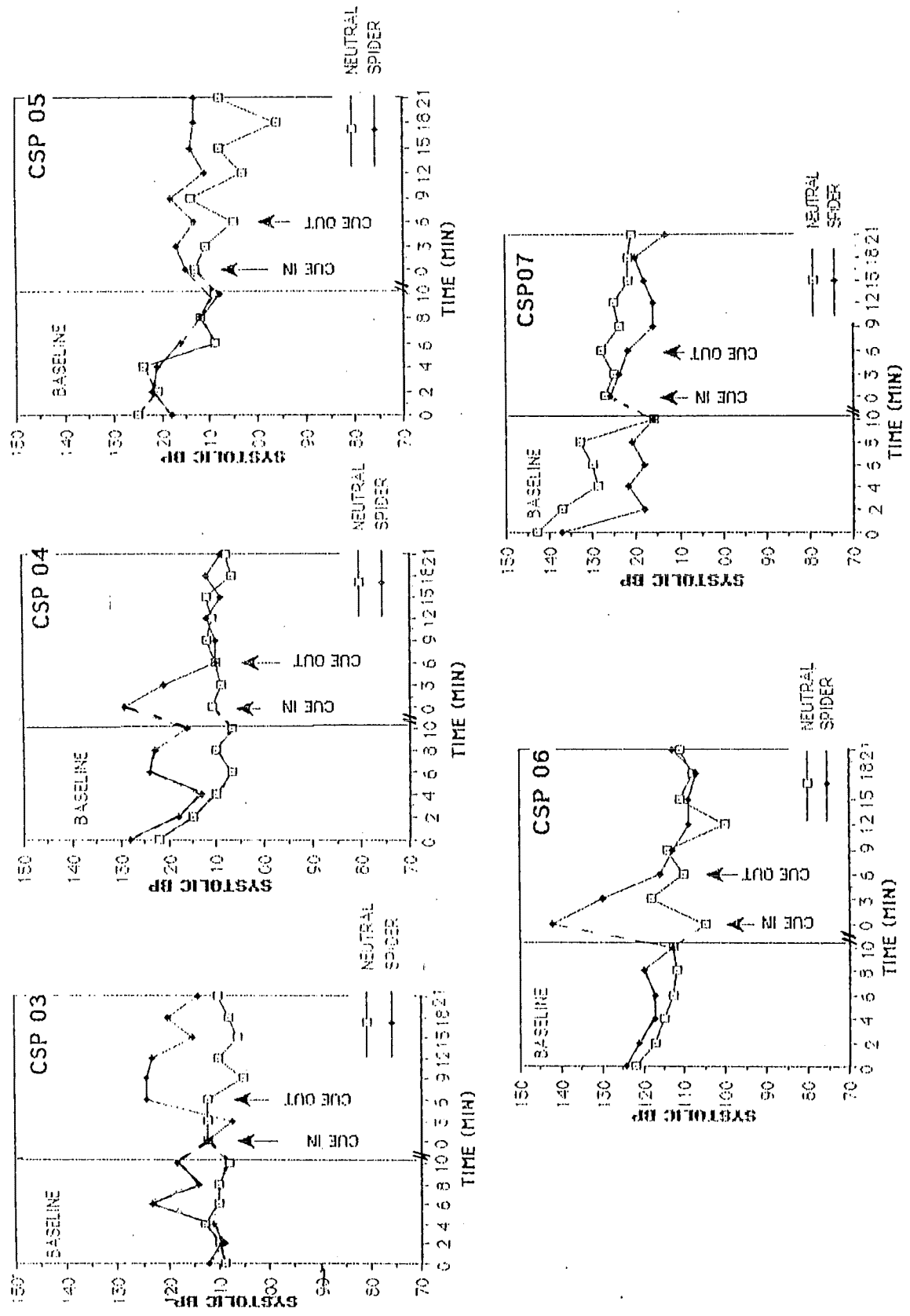
BASELINE
3 MINUTES
21 MINUTES
TIME
NEUTRAL
SPIDER
neutral
spider

APPENDIX G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CSP 04
CSP 03
CSP07
CSP 06
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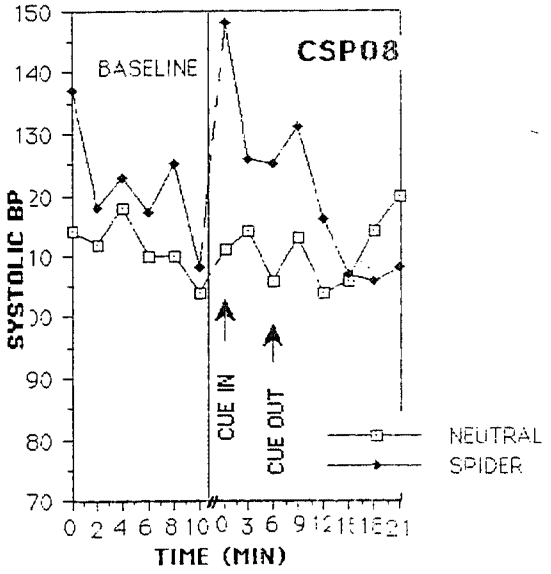
CUE IN
CUE OUT
NEUTRAL
SPIDER
SYSTOLIC BP
TIME (MIN)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CUE OUT
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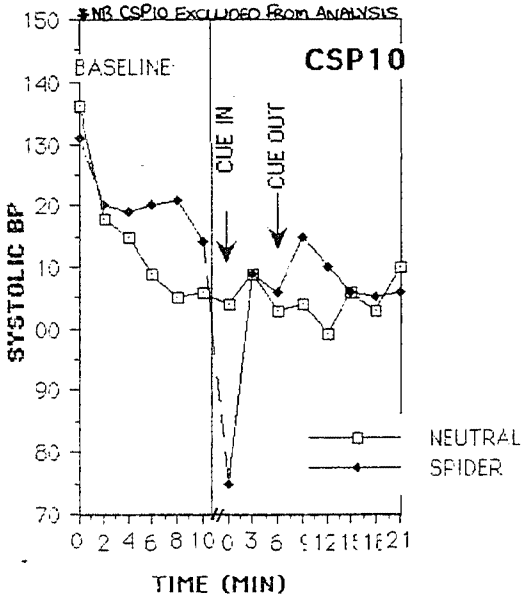
SPIDER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CSP10
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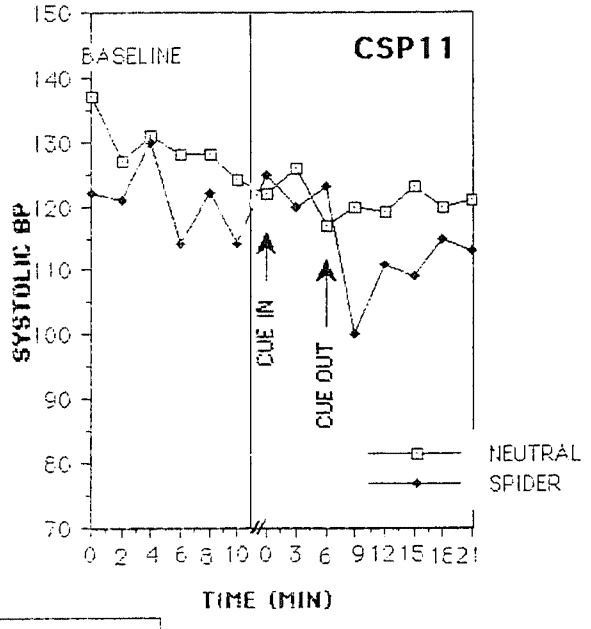
CUE OUT
SYSTOLIC BP
TIME (MIN)
NEUTRAL
SPIDER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CUE OUT
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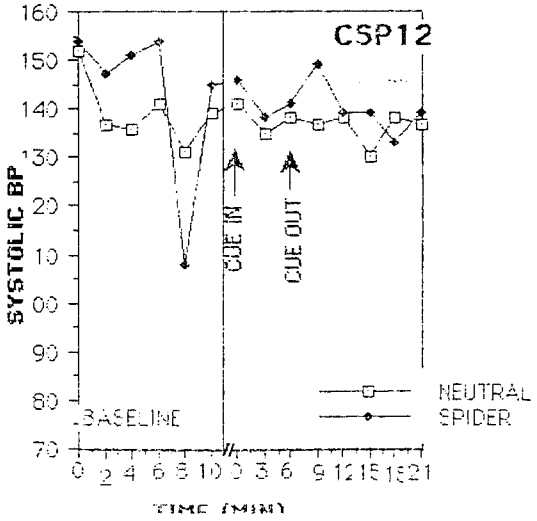
SPIDER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CUE OUT
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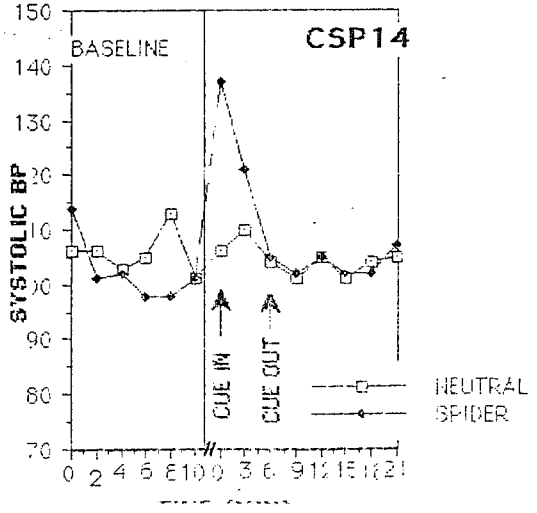
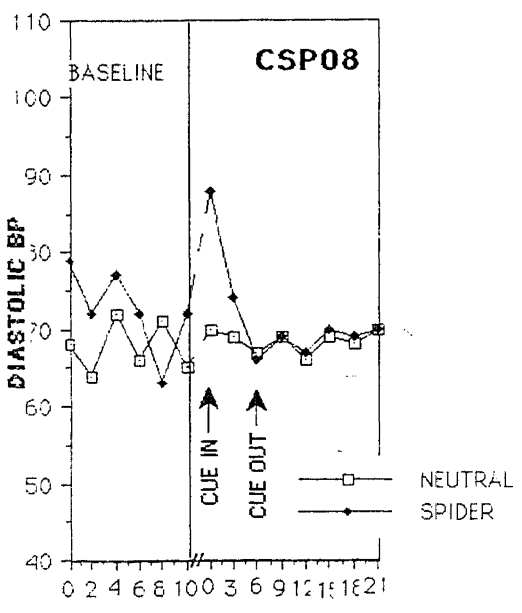
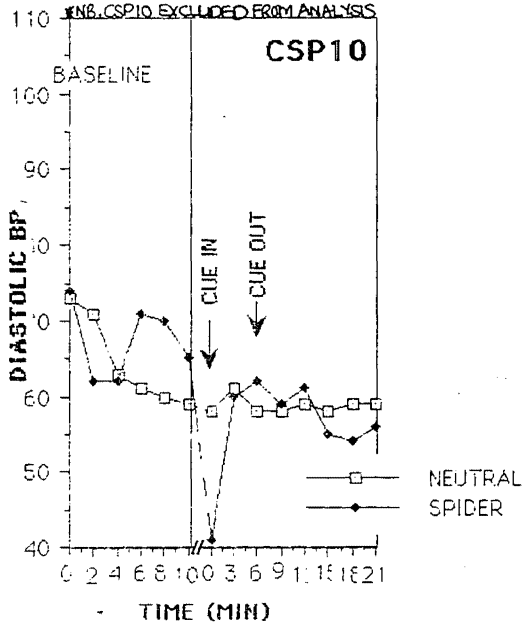
SPIDER

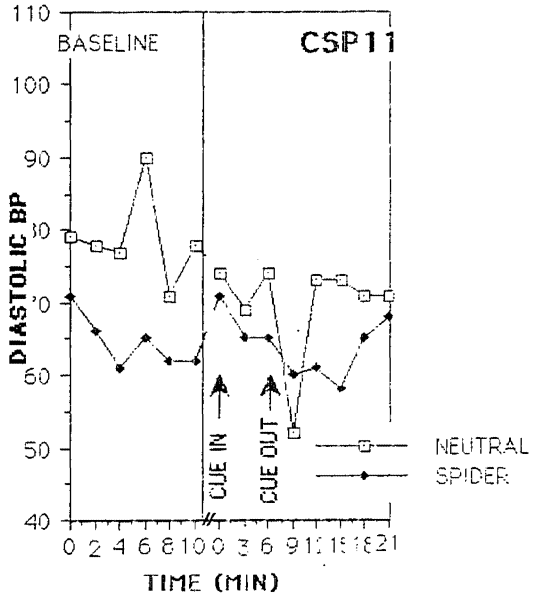

CSP14
BASELINE
CUE IN
CUE OUT
SYSTOLIC BP
NEUTRAL
SPIDER

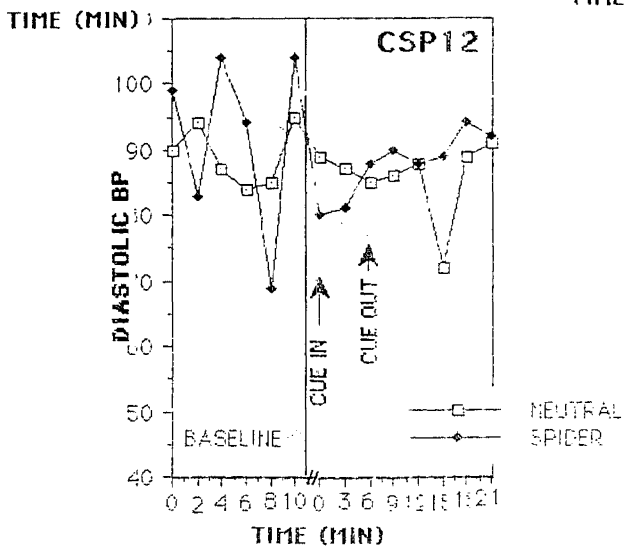
APPENDIX H

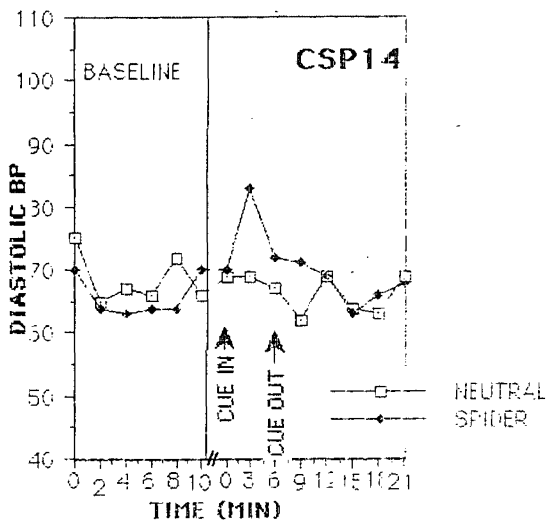
CSP03
CSP04
CSP05
CSP06
CSP07
BASELINE
CUE IN
CUE OUT
NEUTRAL
SPIDER
DIASTOLIC BP
TIME (MIN)

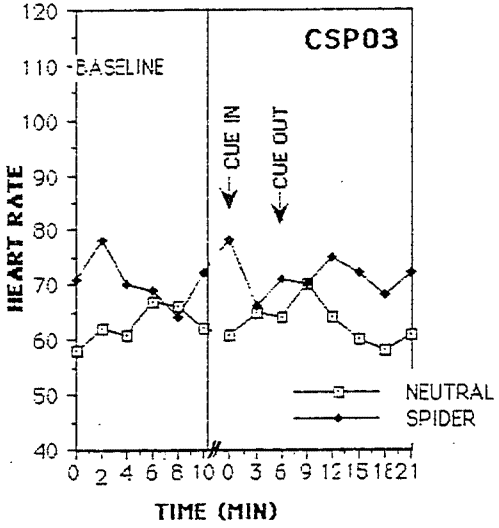

CSP08
BASELINE
DIASTOLIC BP
110
100
90
80
70
60
50
40
CUE IN
CUE OUT
NEUTRAL
SPIDER
0 2 4 6 8 10 0 3 6 9 12 15 18 21
TIME (MIN)

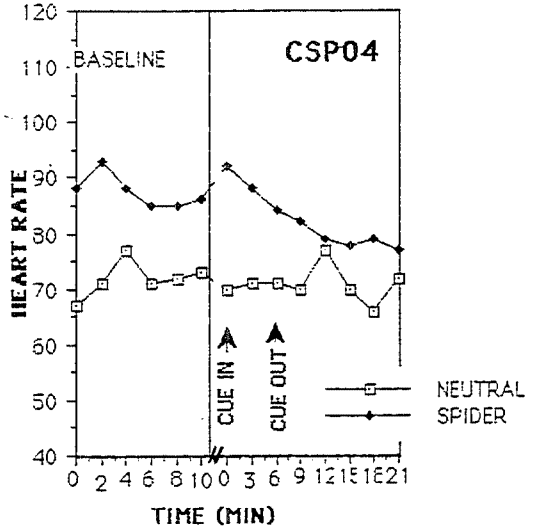

*NB. CSP10 EXCLUDED FROM ANALYSIS
CSP10
BASELINE
DIASTOLIC BP
110
100
90
60
50
40
CUE IN
CUE OUT
NEUTRAL
SPIDER
0 2 4 6 8 10 0 3 6 9 15 18 21
TIME (MIN)

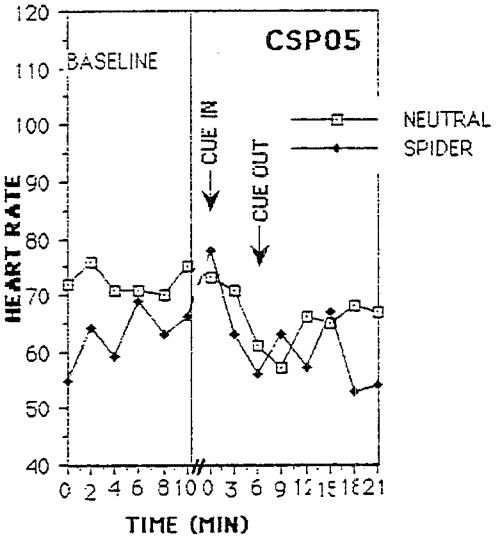

CSP11
BASELINE
DIASTOLIC BP
110
100
90
60
50
40
CUE IN
CUE OUT
NEUTRAL
SPIDER
0 2 4 6 8 10 0 3 6 9 15 18 21
TIME (MIN)

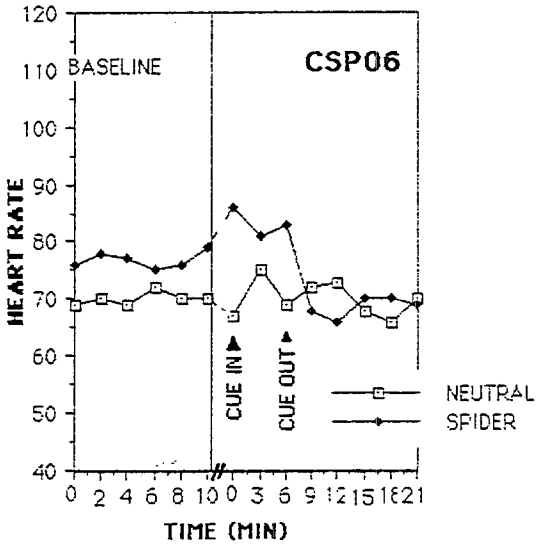

CSP12
BASELINE
DIASTOLIC BP
100
90
60
50
40
CUE IN
CUE OUT
NEUTRAL
SPIDER
0 2 4 6 8 10 0 3 6 9 12 15 18 21
TIME (MIN)

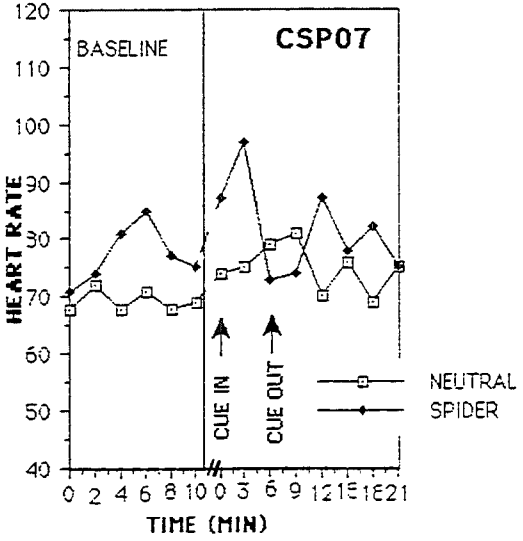

CSP14
BASELINE
DIASTOLIC BP
110
100
90
70
50
40
CUE IN
CUE OUT
NEUTRAL
SPIDER
0 2 4 6 8 10 0 3 6 9 12 15 18 21
TIME (MIN)

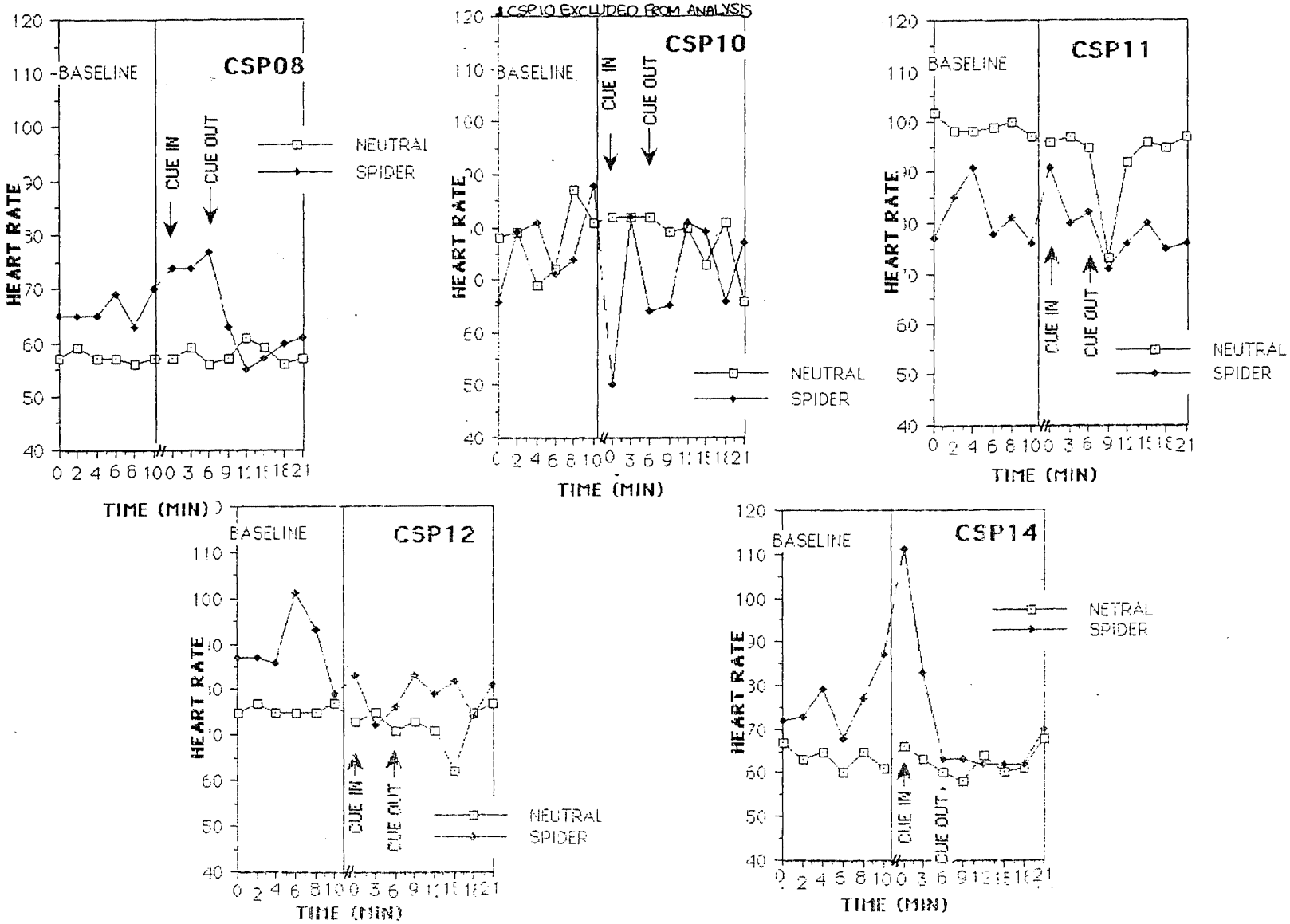

CSP03
BASELINE
CUE IN
CUE OUT
HEART RATE
TIME (MIN)
NEUTRAL
SPIDER

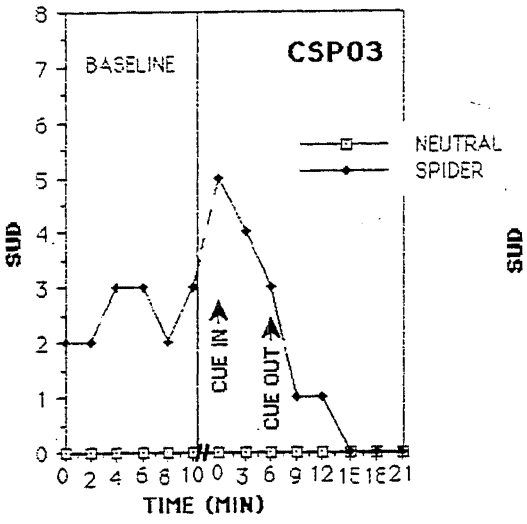

CSP04
BASELINE
CUE IN
CUE OUT
HEART RATE
TIME (MIN)
NEUTRAL
SPIDER

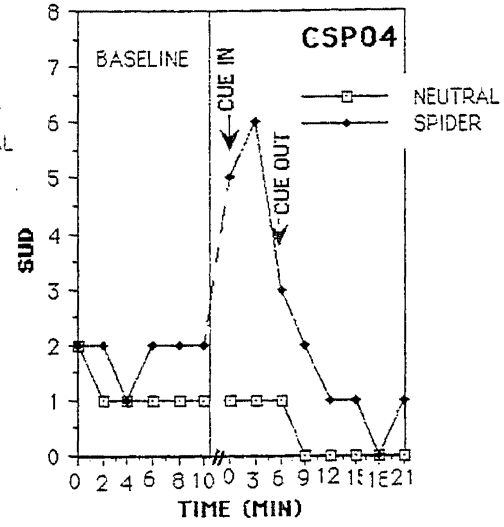

CSP05
BASELINE
CUE IN
CUE OUT
HEART RATE
TIME (MIN)
NEUTRAL
SPIDER

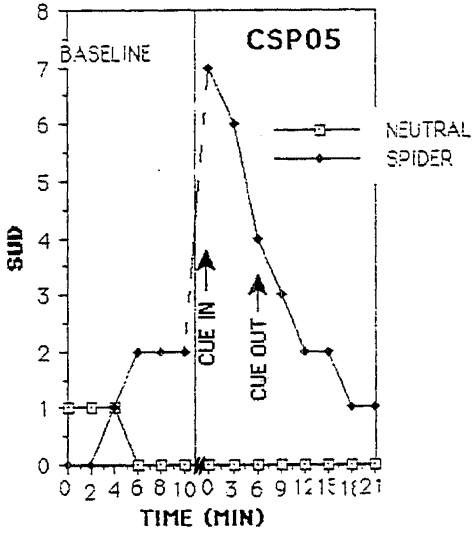

CSP06
BASELINE
CUE IN
CUE OUT
HEART RATE
TIME (MIN)
NEUTRAL
SPIDER

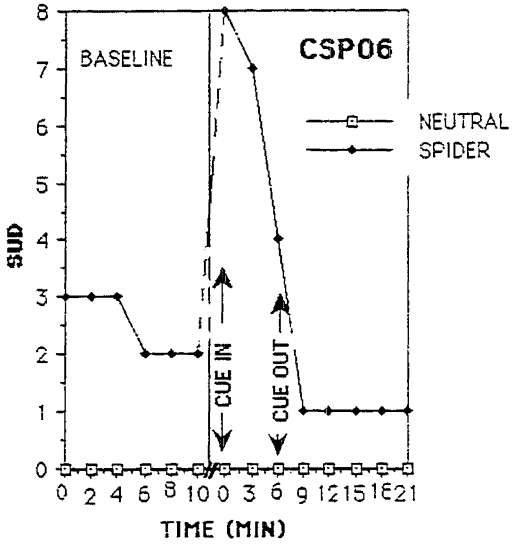

CSP07
BASELINE
CUE IN
CUE OUT
HEART RATE
TIME (MIN)
NEUTRAL
SPIDER

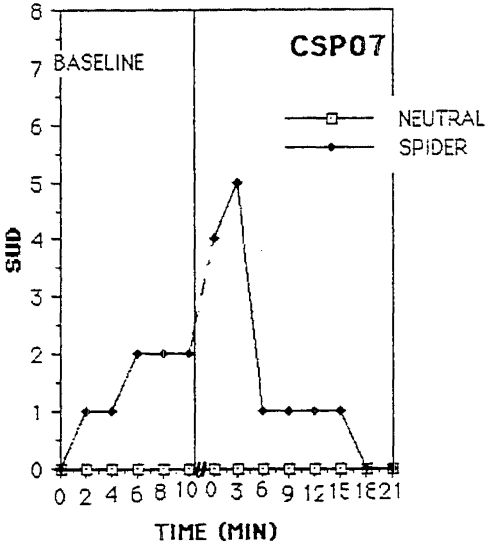

CSP08
BASELINE
CUE IN
CUE OUT
NEUTRAL
SPIDER
HEART RATE
TIME (MIN)
CSP10 EXCLUDED FROM ANALYSIS
CSP10
CSP11
CSP12
CSP14

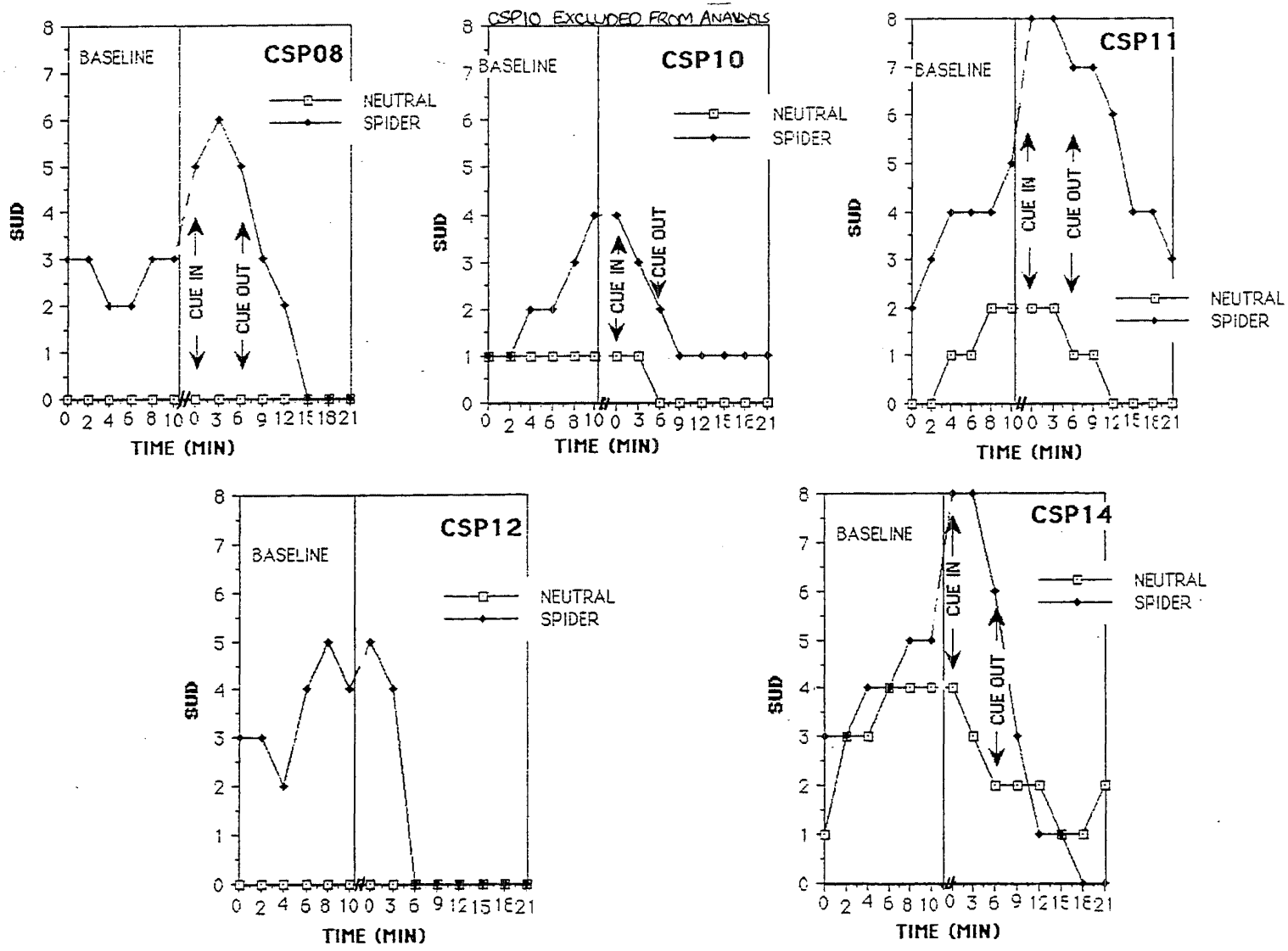

CSP03
BASELINE
NEUTRAL
SPIDER
CUE IN
CUE OUT
SUD
TIME (MIN)


CSP04
BASELINE
CUE IN
CUE OUT
NEUTRAL
SPIDER
SUD
TIME (MIN)


CSP05
BASELINE
NEUTRAL
SPIDER
CUE IN
CUE OUT
SUD
TIME (MIN)


CSP06
BASELINE
NEUTRAL
SPIDER
CUE IN
CUE OUT
SUD
TIME (MIN)


CSP07
BASELINE
NEUTRAL
SPIDER
SUD
TIME (MIN)


CSP10 EXCLUDED FROM ANALYSIS
CSP08
CSP10
CSP11
CSP12
CSP14
BASELINE
NEUTRAL
SPIDER
CUE IN
CUE OUT
SUD
TIME (MIN)